G.B.

AIR MINISTRY

AIR PUBLICATION 3139

PSYCHOLOGICAL DISORDERS IN FLYING PERSONNEL of the ROYAL AIR FORCE

INVESTIGATED DURING THE WAR 1939-1945

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The following reports on investigations into psychological disorders in flying personnel during the war period 1939–1945 are issued for the information and guidance of the senior executive and all medical officers of the Royal Air Force.

By Command of the Air Council.

W. B. Brown

LONDON : HIS MAJESTY'S STATIONERY OFFICE
1947

Air Ministry,
Kingsway,
London, W.C.2.

To the Permanent Under Secretary of State for Air.

Sir,

I have the honour to submit a survey of psychological disorders in flying personnel of the Royal Air Force investigated during the war 1939–1945, to enable the medical branch to give authoritative advice to the executive on the operational limit of members of air crews.

The study was begun at operational commands in 1942 by Air Vice-Marshal Sir Charles P. Symonds, K.B.E., C.B., M.D., F.R.C.P., Consultant in Neuro-psychiatry, and Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P., Specialist in Neuro-psychiatry. Field investigations were carried out in the operational commands by Squadron Leader D. D. Reid, M.D. An assessment of the incidence of predisposition to psychological disorders in flying personnel showed that two-thirds of individuals who failed to withstand the stress of flying were predisposed to nervous breakdown. As this group undoubtedly contained individuals capable of adapting themselves satisfactorily to operational flying, it was decided that only severely predisposed individuals should be rejected at entry, and that those with other degrees of predisposition should be watched carefully during training and eliminated if signs of temperamental unsuitability appeared.

For this reason the attention of medical officers and flying instructors was directed to signs of temperamental unsuitability for duties as members of air crews. Flying instructors are particularly well placed to discern signs of nervousness in the air from observation of pupils in the mirror, from their manner of handling the controls and obeying instructions, and from observation of behaviour on the ground, such as lack of keenness, excuses for putting off flying, and reporting sick for trivialities.

Surveys of psychological disorder in air crew showed similar findings year by year: about 3,000 cases of nervous breakdown and 300 of lack of confidence annually, which indicated that a uniform standard of psychiatric examination was being maintained.

As regards type of flying duty associated with breakdown, one-third of the neurosis cases occurred in Bomber and one-third in Flying Training Commands, the remainder being distributed among flying personnel of Coastal, Fighter and Transport Commands. One-third broke down without experience of operational flying, one-third with under 100 hours' and one-third with over 100 hours' operational flying.

Types of nervous breakdown were chiefly anxiety and hysteria, both together accounting for over 90 per cent of cases. Practically all cases of nervous breakdown (98·4 per cent) arose from underlying psychological rather than physical causes.

Analysis of the disposal of cases of psychological disorder showed that 22½ per cent of cases returned to full flying and 3½ per cent to limited flying; the majority of cases, 72 per cent, were grounded; 1·9 per cent required to be invalided.

In 1945, the reliability of the psychiatric method of diagnosing psychological disorders in R.A.F. flying personnel was investigated by statistical methods by Professor A. Bradford Hill, D.Sc., Ph.D., and Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P. A fair degree of agreement in psychiatric diagnosis was found in the assessment of severe predisposition, but in the other degrees of predisposition the disagreement was such that it was decided that the psychiatric assessment per se should not be used in selection of air crew at entry but should be regarded as one medical factor to be taken into account by the selection board in the final summing-up.

I have the honour to be, Sir,
Your obedient Servant,

H. E. WHITTINGHAM
Director-General of Medical Services,
Royal Air Force.

January, 1946.

CONTENTS

Contents—*contd.*

CHAPTER I

CRITICAL REVIEW OF THE PUBLISHED LITERATURE

by

Air Vice-Marshal Sir Charles P. Symonds, K.B.E., C.B., M.D., F.R.C.P., and Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

FPRC Report 412 (b), January, 1942

Introduction

Although medical officers in civil and military flying centres have recognised pyschological disorders in members of air crews since the latter part of the war of 1914–18, few descriptions of these disorders can be found in the medical literature. Until recently they escaped the notice of the trained psychiatrist, so that those accounts which have appeared have been based upon the observations of medical officers whose interests have been more general. In consequence, these disorders have been described mainly in relation to other aspects of aviation and have not received the detailed attention which they deserve.

The growth of aviation has occurred at a time when there have been great changes in the field of psychological medicine. This association has engendered confusion in thought and terminology so that the literature must be reviewed with a critical interest in its place in modern psychiatry as well as with regard to its direct relationship to aviation.

1. General description and symptomatology

Anderson (1919) reported psychological disorders in 10 per cent of 600 pilots in squadrons under his care in the 1914–18 war. He found that these disorders occurred early in flying training, or later in the stress of active combatant flying. Symptoms sometimes arose after the pilot's first solo flight, or when he first flew a new type of plane. Later on the precipitant was often a crash or the witnessing of a disaster, but occasionally the symptoms did not appear until the ill effect of further flying stress became cumulative. He noticed the frequency with which neurasthenic symptoms occurred, the patients showing great fatigue, irritability, and apathy, but he also recorded the occurrence of hysterical manifestations. Anderson differentiated clearly between the psychological illness arising during training, and those disorders resulting from the experiences of war flying. In the first group the prognosis was so bad that he recommended permanent removal from flying duties. When a pilot had completed 100 hours of operational flying the position was different, especially if there had been any particularly unpleasant precipitating cause, and it was his experience that in these cases simple psychotherapy was successful in returning the pilot to flying duties—" the earlier the stage of onset of the neurosis in a flying man's career the more hopeless it is to deal with or cure." In all cases he stressed the importance of psychological examination as soon as possible after symptoms had appeared.

At the same time Gotch (1919) reported a larger group of 200 cases of psychological disorder which he described in some detail. His system of case-note taking, with insistence upon a full family and personal history, including childhood reactions and behaviour traits, adjustment to the Service and to flying conditions, as well as details of the man's flying experience (types of craft, total and operational hours, combats, maximal and average heights, unpleasant experiences, degree of confidence, and so on) bear a very close resemblance to the system used to-day. Gotch described the major symptoms in each group and pointed out that the neuroses resulting from flying duties had the same symptom patterns as neuroses arising from other causes and in other occupations. In discussing treatment he distinguished between the management of a case of pure fatigue and that of *neurosis*. Like Anderson, he concluded that the shorter the flying experience the worse was the prognosis, but he thought that with early psychotherapy, including a full investigation, explanation, reassurance and rest the majority of the disorders resulting from war flying should resolve completely.

It was recognised by the observers in contact with pilots in the 1914–18 war that the reaction types of the psychological disorders arising in them and in other members of air crews did not differ fundamentally from the psychological illnesses of civil life. In his Goulstonian Lectures, Birley (1920) described vividly the deterioration of pilots as a result of the great stress of aerial warfare during 1917 and 1918. He showed that after the young pilot had reached the zenith of his efficiency, fatigue, uncertainty, fear and physical distress caused a decrease in his efficiency, his powers of leadership and his offensive spirit. The appearance of this deterioration depended upon the quality of the man and the degree of stress with which he had to contend. He traced the syndrome from its beginnings in a loss of zest for flying to a fully developed anxiety state, and said that although the men called it ‘ wind up ’ the condition is in fact an anxiety neurosis. The presence of this anxiety neurosis became a permanent and difficult problem in the latter months of the war, when the type of men entering into the Service had deteriorated and the powers of resistance were insufficient for the stress encountered. It is quite apparent from these observations that Birley did not consider these psychological disturbances to be specific to flying, and he refers to the degree of flying stress as only one of the causes of the neuroses in flying personnel. Dudley (1918) had expressed similar views when he said that the condition of nervous exhaustion seen in pilots depended upon the temperament and character of the pilot, the type of work and the machine he used, the weather and the environment of the aerodrome.

Anderson (1919) and Gotch (1919) similarly did not consider that the neuroses seen in pilots were diseases sui generis, but they realised that they were the result of unusual stresses acting upon individuals with varying degrees of predisposition. Gotch sums up his views by saying: “ War flying imposes as great a stress as is possible on men in their most unstable years.” Rook (1939) on the basis of his experience writes : “ One fact which was clearly brought out in the war was that any individual would sooner or later break down if the stress was sufficiently severe.”

Head, in his report on the sense of stability and balance in the air (1919), pointed out that such factors as loss of confidence or anxiety from extraneous causes such as family worries or unpleasant experiences associated with war flying, may cause regression in the efficient performance of flying duties. Rippon and Manuel (1918) discussing the place of temperament and physical fitness in aviation, described deterioration in performance in predisposed individuals. Dudley (1918) also described a state of nervous exhaustion which depended for its appearance upon the personality and the stress to which the personality was subjected.

In other belligerent countries there was simultaneous interest in the incidence of psychological disorders in air crews. This is shown by the number of papers which were published immediately after the 1914–18 war in France, Germany, America and Italy concerning the selection of air crews upon psychological criteria (vide infra). As in this country, few described the disorders themselves. Perrin de Brichambaut (1921), in discussing the merits of different methods of selection, touched upon the causes of neurosis in air crews, while Dockeray and Isaacs (1920) reviewed the opinions held in the allied countries at the end of the war.

Except for Bauer's monograph " Aviation Medicire " in 1926 no further significant work appeared until the development of commercial aviation in the early thirties, when interest in selection of flying personnel and in physical and physiological aspects of flying grew, particularly in America and Germany. Unfortunately much of the German aviation literature is not at present available. Schubert (1935) and Armstrong (1936 and 1939) described neuroses occurring in pilots. Their views will be discussed later in relation to the present work. A series of general dissertations upon the psychology of flying (Reinartz 1932, Jensen 1936, Patient 1938, Walshe 1941) have not advanced knowledge in any specific direction.

The reaction types recognised by different observers in psychological disorders in flying personnel have been described under many names. Anderson (1919) divided the types into neurasthenic or hysterical, and said that the chief symptom in the neurasthenic though often denied was aerophobia—fear of flying. He added a group of cases arising after a flying accident, and said the condition is absolutely the same as the traumatic neurosis known as railway spine or railway brain. Gotch (1919) divided his cases upon aetiology, but his descriptions include simple fatigue, anxiety states, neurasthenia and loss of confidence without any psychological illness. Birley (1920) distinguished between pure fatigue, fear, a mixture of these disguised by the patients in such terms as wind up and a fully established anxiety neurosis. Many of the early writers considered these psychological disorders generically under an omnibus title which included such names as: flying stress, aviators' neurasthenia, aero-neurosis (Anderson, 1919), chronic fatigue, staleness, aviators' stomach, aeroasthenia, and simply fatigue (Armstrong 1939). Both these authors favoured the name aero-neurosis, but in this country flying stress used originally by Flack to describe the main cause, was later used incorrectly to refer to the effects, the neurosis itself. In America the name aero-neurosis has found favour, while on the Continent mal des aviateurs (Perrin de Brichambaut 1922) was popular among a similar range of synonyms (Schubert 1935).

This accent upon a name, so common in medicine, and usually so unfortunate in its results, endowed these syndromes with a false specificity and the recognised division of psychological disorders into reaction types, and the explanation of these types upon the basis of personal predisposition and environmental stress was ignored. After the war of 1914–18 cases were not studied systematically until civil aviation matured in the United States. The natural consequence was that when psychological disorders again made their appearance in association with commercial aviation they were considered to be specifically due to the physical and mental hardships of flying, and a new disease was born. Thus in 1936 Armstrong published a paper entitled " A special form of functional psychoneurosis appearing in airplane pilots." He called this new syndrome " aero-neurosis " and later (1939) stated—" There are two general types of neurosis which develop in airplane pilots. One type develops in relatively stable individuals, is not necessarily disabling, and is an entity seen only in aviators. The other type develops in relatively unstable pilots or in relatively stable pilots under conditions of unusual stress, is disabling, and is identical with those neuroses seen in general practice. The former is known as aero-neurosis while the latter is composed of the ordinary neuroses which have flying as the principal inciting cause." He defined aero-neurosis as "a chronic functional nervous disorder occurring in professional aviators, characterised by gastric distress, nervous irritability, fatigue of the higher voluntary mental centres, insomnia, and increased motor activity." No criticisms of this division of the neuroses seen in flying personnel have since been published, but it is at variance with the view of observers during the war 1914–18, who either tried to bring the symptom patterns into line with recognised psychiatric reaction types, or who looked on the psychological illnesses as one group under a single heading. Archer (1939) divided the psychogenic disorders resulting from active Service flying aetiologically into those conditions developing in otherwise healthy stable individuals—anxiety states; and those which are due to the revelation of latent mental instability—psychoses, anxiety states, hysterical syndrome, and the disclosure of a psychopathic personality. He said that these conditions had to be differentiated from those due to toxaemia, epilepsy or organic disease of the nervous or other systems.

As no other serious attempts to describe the reaction types have been found in the literature, the charge made in the opening paragraph of confusion in thought and terminology in the psychological disorders in flying personnel is well founded.

2. Aetiology

Gotch (1919) emphasised the difference between the effects of flying per se and operational flying. He found that although pilots who break down after an accident late in their flying careers usually made a full recovery, the prognosis was bad if the accident had been caused by fire in the aircraft, breakage of the machine, or a direct hit by anti-aircraft fire.

Birley (1920) thought that the special susceptibility of an operational pilot to such a breakdown depended particularly upon the hazardous nature of his work—for instance, fighter pilots were more vulnerable than artillery observers, the irregular hours of sleep, the individual nature of the responsibility shouldered, the fatigue of flying as such; possibly the physical effects of altitude and the deterioration in morale of fatigued men in contact with each other.

3. Constitutional predisposition

Gotch found evidence of some degree of nervous instability in the families of 167 of his 200 cases of psychological disorder in air crews, so that 83 per cent were definitely predisposed, a significant point in relation to the discussion upon the selection of air crews which appears later. He recognised several distinct aetiological types of psychological disorder—those physically and mentally stale, showing symptoms of pure fatigue; those with mental breakdown due to identifiable psychological causes—these were grouped as neurasthenia; those with a similar breakdown, attributed to toxic causes such as influenza, malaria, dysentery, tuberculosis or oral sepsis; those showing disorders of conduct (these included all who showed themselves unstable or untrustworthy, for he used the term psychopaths in a broader sense than it is used to-day); those with physiogenic mental breakdown caused by such factors as oxygen lack at high altitude, airsickness or heterophoria; and a small group of frank malingerers.

4. Temperamental causes

So many different types of temperament are met in successful pilots, that it seems simplest to begin by describing those traits the presence or absence of which have been found to cause inefficiency in flying. Even were there not such a wide variation between personality type and any specific performance, the attempt to link the two would be difficult, and McDougall (1913) said à propos of such an attempt—"Some of the best modern psychologists have been led into absurdities by attempting this impossible task . . . in one respect only can we make a decided advance upon the ancients, we can realise the great complexity of the problem and can frankly admit ignorance." Birley (1920) referring to war flying, put the matter simply by drawing attention to two men of widely different temperament who both pursued their same highly specialised vocation with consummate skill—Dr. W. G. Grace and Prince Ranjitsinghi. Head (1919) said: "Flying introduces no elements which are not in evidence in riding a motor bicycle, game-shooting, cricket or golf," and related the abilities to pursue these interests and to fly efficiently. This relationship is not now so close as it was 24 years ago, for the efficient extension of the body image to the end of a club, or the wings of a small plane, is a more intimate and less mechanical affair than the same extension in a modern four-engined bomber. When the bomber is flown by instruments alone, the personal projection alters and different factors operate.

Even if an individual's temperament is suited to flying, it must be realised that aptitude for flying per se does not necessarily indicate temperamental suitability for operational flying, which calls for additional qualities. Those who are devoid of flying ability do not reach the state of operational training, so that in practice both forms of aptitude are often considered together (Birley 1920). The disparity between the temperamental ability to fly and to fly in operations may be striking and was described by Thorndike (1919).

The great diversity in temperament which is compatible with success in aviation is reflected in individual views upon the desiderata for ideal pilots. Dockeray (1920) thought that quiet methodical men became the best pilots in the U.S. Army Air Corps, but ten years later a report of the School of Aviation Medicine stated that strong and active instincts of exploration and curiosity were desirable. Similarly, Patient (1938) concluded that there was no difference between the ability of the introvert and the extrovert to become good pilots. Rook (1939) said : " Many of the pilots who won Victoria Crosses in the war were of a quiet sensitive type, and some were distinctly hyper-nervous."

Birley (1920) in his report upon temperament and Service flying, drew attention to the individual nature of the pilots' work in the R.A.F. in contrast to the more gregarious conditions of duty in the other Services, and stressed the additional temperamental requirements needed for such exacting service. But with this broad generalisation he admitted that exact temperamental requirements could not be defined, and he thought the difficulty so great that accurate selection upon the basis of temperament, personality, and character was impossible. He said: "We cannot at present identify the potential cricketer or mathematician except by watching how the former catches a ball and how the latter does sums, and the same principles would seem also to apply to the art of flying." Rivers and Rippon (1920) after attempting to correlate performance with temperament, on the basis of personal interview, came to the same conclusion. Anderson (1919) while he held that there was a definite temperamental aptitude for flying, said that its definition and recognition were very difficult. Although temperamental suitability appears so unpredictable, unsuitability is the main cause of many of the psychological disorders which arise in flying personnel. " In certain cases flying did not cause, but unmasked a pre-existing condition " (Birley 1920). Temperamental unsuitability is therefore a major concern of selectors of candidates for flying duties. Selection of air crews will consequently be considered in relation to temperament later in this review.

5. Flight factors causing psychological disorders

(*a*) The factors in flight which predispose to psychological disorders have been reviewed by Porter (1936) and Armstrong (1939), and literature upon the physiological effects of flying has recently been assembled by Razran and Brown (1941). Reports upon the causes of psychological disorders arising from flying in British pilots were made after the war 1914–18 by Flack and Birley in the special report upon the medical problems of flying (1920) and in the U.S.A. by Dockeray and Isaacs (1921). Aspects of this subject have already been discussed earlier in this review, pertinent references being quoted.

(*b*) *Fatigue*.—The most important single predisposing cause of psychological breakdown in flying personnel is fatigue. Viteles (1932) has discussed occupational fatigue factors, and an excellent review of the general literature upon fatigue has been made by Smith (1941). Miller (1936) described the forms of fatigue found in pilots. Richardson (1935), Porter (1936), Whittingham (1939), Armstrong (1939) and McFarland (1941) have dealt with the many causes of fatigue which are inherent in civil and military flying.

Armstrong (1939) lists the main causes of occupational fatigue in flying as those due to physical agents—extremes of temperature, vibration, glare, noise, wind, accelerations and changes in atmospheric pressure, oxygen lack, carbon monoxide and emotional stress—physical discomfort, responsibility, attention, concentration, alertness, apprehension, anxiety and fear. Many of these causes may arise without regard to flying. McFarland (1941) in discussing pilot fatigue and considering the factors described by Armstrong, detailed some of the methods for their prevention. He found that with proper attention to details cumulative fatigue could be eliminated from civil aviation, but he pointed out that aircraft design, flying conditions and the psychological stresses inseparable from wartime flying produced more difficult and sometimes insoluble problems. He agrees that the fatigue in flying is central in origin, since the neuromuscular causes of fatigue are not present, and many of the factors producing fatigue are psychological. On the basis of Cannon's work (1929) he thinks it possible that the very lack of physical movement may have a cumulative deleterious effect. The response of the vegetative nervous system, in association with the appropriate endocrine responses to emotional stress, is in primitive states accompanied by bodily activity. The inhibition of this activity through the requirements of flying interferes with this biological response and may well have a cumulative ill effect on the efficiency of the individual undergoing the stress. Lottig (1937) had previously drawn attention to this relationship between behaviour and the vegetative system in producing fatigue in pilots.

(*c*) *High altitudes*.—The physiological responses to the well recognised changes encountered at high altitude, especially the fall in barometric pressure, oxygen content of the atmosphere and temperature have been studied in relation to pure physiology (Henderson 1938, Haldane and Priestley 1935) since Bert's original observations in 1878, and in relation to aviation since Glaisher's work in 1862. The literature on the effects of high altitude in aviation is dealt with in Schubert's Monograph (1935), in von Diringshoven's "Medical Guide for Flying Personnel" (1940), and in the standard reference works cited earlier in this review, notably in Chapters 16 and 22 of Armstrong's "Principles and Practice of Aviation Medicine" (1939).

The psychological effects have received less detailed and much less accurate and critical scrutiny. The effects may be immediate or cumulative. The immediate changes were called *altitude sickness* by Schneider (1918) and they arise during single periods of anoxia. In the last war attention was drawn to the intellectual and physical changes associated with flying at 18,000 ft. without oxygen. It was known that perception was diminished and judgment impaired (Birley 1920), and that there was a gradual decrease in efficiency; (Corbett and Bazett 1920), and Birley's Goulstonian lectures (1920) deal with the subject in some detail. McFarland (1939) has shown that the first demonstrable evidence of neuro-muscular and psychological inefficiency occurs at about 12,000 feet. The symptoms, described by Armstrong (1939), are very variable. After initial anxiety they range from tiredness, depression, lethargy and apathy to euphoria, hilariousness, pugnacity and uncontrolled laughter, but he stresses the important place of fatigue in all the symptom patterns encountered. Besides being demonstrably inefficient to testing, the subject feels tired. Neuro-muscular control, judged by handwriting and co-ordinated behaviour tests, begins to show deterioration at 14,000 feet, and this objective change is accompanied by psychological deterioration. The field of attention becomes narrowed, memory is defective and there is loss of judgment and self-criticism. The effect of this deterioration upon attention, concentration, memory, ability to perform mental and manual work, colour-naming, card-sorting, and writing, have been reported in papers listed by Razran and Brown (1941).

Cumulative ill-effects of repeated exposure to high altitude were also recognised in the last war, and were described by Birley (1920) and Corbet and Bazett (1920). These observers were impressed by the deterioration in performance, increasing fatigue, and inability to withstand the same degree of stress in pilots who had made frequent ascents to high altitude without oxygen, but the heights flown without oxygen were sometimes up to 18,000 to 20,000 feet. They also observed a relationship between the number of high altitude flights and this cumulative fatigue, and found that the pilots' capacity to withstand anoxia gradually fell. Armstrong (1939) records that the number of unexplained fatal crashes in the war 1914–18 fell dramatically when oxygen equipment came into general use, and that in America before the use of oxygen became obligatory, civil pilots complained of chronic altitude sickness. Armstrong and Hein (1939) were able to produce irritability, nervousness, insomnia, an increased difficulty in mental concentration, retention and attention, with total lack of insight, in a group of students subjected to an oxygen tension equal to 12,000 feet each day for 29 days. Armstrong also reports bodily and mental fatigue, lassitude, sleepiness, lack of volition, pronounced irritability and disregard for danger in pilots who flew at high altitudes (12,000 to 16,000 feet) without oxygen during photographic reconnaissance. Symptoms persist after the series of ascents has ceased, the pilot remaining unduly fatigued, apathetic and inefficient, although no evidence has been produced to show that there are any permanent structural effects and ultimate recovery is the rule. Miller (1936) suggested that adrenal dysfunction may play some part in producing deterioration after repeated anoxemia, but reasons were tenuous. Giragossintz and Sundstroen (1937) described destructive changes in the adrenal glands of rats after repeated exposure to low atmospheric pressure and these changes were associated with adrenal cortical insufficiency. Armstrong and Hein (1938) showed that histological changes are present in the adrenal glands of rabbits subjected to four hours at the equivalent of 18,000 feet each day for five weeks and over. They speculate upon the relationship between chronic altitude sickness and the clinical effects of dysfunction of the cortex of the adrenal glands. Lottig (1937) as has been mentioned already also postulated a relationship between the psychological changes seen in pilots and the functional activity of the vegetative nervous system. The earlier work on the effects of diminished oxygen tension upon the activity of adrenal glands has been described in a special report by the Air Medical Investigation Committee of the Medical Research Council (1918). It seems that this abnormal fatigue state must have a physical cause, which may possibly have its basis in some such inadequacy of the sympathetico-adrenal mechanism, but the evidence of this is not yet very strong.

The other effects of altitude related to decreased atmospheric pressure are not usually the direct cause of psychological disorders in flying personnel, and will not in consequence be reviewed. Armstrong (1939) has dealt with them exhaustively.

6. Other physical causes

Many less dramatic causes of psychological deterioration in flying personnel have been described. The type of aircraft itself and the conditions existing in the airfield (Dudley 1918), noise (Richardson 1935, Whittingham 1939, McFarland 1941), discomfort (Richardson 1935), unsuitable clothing (Whittingham 1939), cold (Birley 1920, and many others), glare (Livingston 1932, Whittingham 1939) and vibration (Grow 1936). They have been dealt with at length by Armstrong (1939), McFarland (1941) and Whittingham (1939), and need not be enlarged upon here.

7. Psychological causes

The predisposing constitutional causes of psychological illness have been considered in relation to aviation, and the flight factors causing fatigue and deterioration have also been referred to. The literature upon fatigue itself has been reviewed. There remains the host of precipitating and contributory causes of a purely psychological nature. The chief of these is *fear*. As this review is primarily concerned with the practical preventive aspects of psychological disorders in flying personnel, many of the aspects of fear inseparable from wartime flying are beyond its scope.

Fear whether acute or long drawn out, then usually called anxiety, seems to be an integral part of the stress of flying and with this in mind Rook (1939) has said: "All flying to some extent produces a nervous strain in the individual. The average young adult approaches flying with little fear, his senses fill with the thrill of speed, and the joy of controlling a wonderful piece of machinery. Some, more imaginative, pass through a period when fear has more or less to be consciously repressed, eventually gaining confidence with increasing skill. For some, fear never wholly disappears, and symptoms of an anxiety state may occur at an early period of their training. Even the most seasoned pilots may show that loss of confidence which, unless immediately treated, will end in a frank anxiety state. Suddenly, for some reason not obvious to the outsider, some minor accident, private worries, or even the awakening of a too lively imagination, may liberate a series of repressions."

The view is held by most of those who have close contact with flying personnel that fear in varying degree, at various levels of consciousness, and in different stages of repression, is an accompaniment of flying. This is especially so in wartime. (Birley 1923, Archer 1939), and Rivers (1920) have analysed the fear reaction in relation to physical inactivity and frustrations, an emotional maladjustment particularly common in flying. The literature on war neuroses (reviewed by Dunn 1941) contains a wealth of information upon the part played by fear or anxiety in precipitating psychological illness. The duty of the medical officer in considering all the factors here reviewed is not to dismiss the emotion of fear and its contributory causes, but to realise that if the pilot "can be spared from experiencing in too great a measure the mental conflict which characterises the period of stress, if he can be rested at the crucial moment, he will in a comparatively short time again be fit to return to the fighting line, not to embark again on these critical months of danger and inexperience, but to jump with one bound into a second period of confidence and efficiency " (Birley 1920).

8. Prophylaxis : flight factors

(*a*) *Physical causes.*—The writers referred to on page 8 paid attention to the preventive aspects of these causes. A summary of the literature dealing with the methods used to prevent noise, glare, discomfort, cold, and so on, would therefore involve repetition, as well as much technical material which is beyond the scope of this present review.

(*b*) *Fatigue.*—In reviewing the factors in flight causing deterioration, physical as well as purely psychological, fatigue was given the first place. Fatigue has many physical and psychological causes (Viteles 1932) and all the other factors which have been considered are causally related to it. The reduction of fatigue has been the main thesis in all the papers referred to on pages 6 and 7 concerned with fatigue in flying personnel, and the literature already quoted upon the deleterious physical and psychological factors in flight is pertinent.

(*c*) *Psychological causes.*—The emotion of fear was considered far the most important psychological determinant of the psychological disorders seen in flying personnel. The conscious awareness of fear, depending as it does upon the degree of repression to which the emotion is subjected, is affected by many adverse physical and psychological conditions. Again, these conditions have already been reviewed in the appropriate paragraphs, and repetition is unnecessary. Of particular importance is individual predisposition to fear, largely dependent upon temperament. The reduction of fear by selection of those with suitable temperament for war flying, or rejection of those without, is dealt with under the next heading. But the individual's resistance to deleterious factors does not only depend upon his temperament and character, his physical health and his own psychological adjustment. It is also coloured by the total reaction of his group, that is, by its morale. The literature upon the whole question of morale in relation to war conditions has recently been reviewed by Child (1941).

9. Selection of flying personnel

(*a*) *Constitutional predisposition.*—As determination in efficiency of air crews, as well as evident psychological illnesses, was apparent in the later stages of the 1914–18 war, attempts were made to remove the predisposed individual and to forestall symptoms in the non-predisposed. In devising his cardio-respiratory tests for flying efficiency and flying strain, Flack (1920) was greatly concerned with the psychological as well as the physical make-up of the individuals tested, and his physical tests designed to give some indication of perseverance, will power, and fatiguability. Birley (1920) applied the tests to flying personnel who showed deterioration in flying efficiency, including men who were simply fatigued, temperamentally unfit, and men whose symptoms were attributed to a head injury. He found a great difference between the results of Flack's tests in fit pilots, and in those in a state of chronic fatigue, and also found that after rest and recuperation the standard of performance of the tests rose. It is interesting that a high level of performance was observed in pilots who had been sent home for a rest, in those who had been taken off flying after a trivial head injury, and in those who would not fly, whereas the performance was very poor in those who had had a head injury sufficiently severe to require invaliding, in those who were permanently unfit for flying on medical grounds, in the great majority of those considered temperamentally unfit and in pilots who showed an abnormal psychological response to excessive flying stress. As those considered temperamentally unfit showed unsatisfactory results to the test he concluded that it had merely revealed a predisposition to neurosis. Of men who had lost zest for flying after a trivial head injury he said: "Failure to fly was not so much due to the actual concussion as to the constitution of the individuals concussed. . . . In other words, it is not concussion of the brain which chiefly matters, but concussion of the mind." It is evident from these results that, as he had intended, Flack's tests gave some indication of the temperamental qualities of the individual. These workers approached the psychological problems arising from flying duties from a physical standpoint, but their tests formed the basis of all future methods of selection. Since the war 1914–18, selection of aviation candidates has been based mainly upon physical and secondarily upon psychological testing.

Physical testing.—We are not here primarily concerned with the physical methods of selection, although "more stress should be laid on the suitability or unsuitability of the mental make up of the would-be pilot and less on the actual physical efficiency as found at the original examination, as long as organic disease is absent" (Rook 1939), but they have an indirect bearing upon many of the problems which will be considered later. The general physical tests, and those involving time and the candidate's sustained effort, as opposed to the special tests of organ efficiency, have by their very nature a relationship to temperament. This fact was realised by Flack (1919) who devised his cardio-respiratory tests to give an indication of the candidate's response to fatigue and of his powers of perseverance and determination. "It would seem, therefore, that a routine application of these tests to pilots in training for high flying would indicate the powers of endurance of the subject for the fatigue of high flying." Birley (1920), who was interested in temperament, showed that in practice Flack's tests were valid. Elaborations of these tests are contained in a full survey of the subject in Air Publication 130, "The Medical Examination for Fitness for Flying (R.A.F. and Civil)" (1938). Thorndike (1919 and 1920) described analogous tests in use in the U.S.A. Similar batteries of tests were devised by Schneider (1920 and 1924) and details of the system have been described by Bauer (1926), Armstrong (1939), Mashburn (1939), Spunt (1941) and others. The tests have been discussed in relation to flying efficiency by Rook (1939).

Psychological testing.—The inter-relationship of physical and psychological testing has already been shown on the basis of Flack and Birley's work (1920). Razran and Brown (1941) have recently made a comprehensive summary of this subject, observing that the test construction has been hampered by crude criteria since the war 1914–18, and concluding that it is "really difficult to think of another field of such practical importance as that of the selection of aircraft pilots in which so much confusion reigns, and in which research has been attempted and interpreted by investigators of such varying background and training." A summary follows of the more pertinent aspects of testing to which they refer.

The *criteria for selection* have been based upon the records of various air training schools, in the following ways :—

Successful pilots contrasted with failures during training (Hemmon 1919, Thorndike 1919 and 1920, De Foney 1931 and 1933, Lacker 1937, Longacre 1931, Mashburn 1934).

Accidents *v.* non-accident pilots (Yerkes 1919, Sutton 1930), ratings made by instructors and others (Flack and Bowdler 1920, Hemmon 1919, Nechayeff 1923, Parsons 1918, Stratton, McComas, Coover and Bagby 1920).

Many of the psychological criteria which have been advanced have been shown to have an insignificant relationship to the ability to fly. The tests shown to have practical significance and mentioned by Razran and Brown are :—

The startle tests of emotional stability, and the free association tests of fear of flying (Parsons 1918).

Complex reaction time and judgment tests (Stratton, McComas, Coover and Bagby 1920).

Mental alertness (Thorndike 1919).

Hemmon's battery (1919) evaluating emotional stability, tilt perception, choice reaction, mental alertness and using the Miles ataxiameter complex co-ordinators (U.S. Army Med. Bull. No. 26, 1931, Mashburn 1939).

Various flying analogy tests which have been devised in Germany (Kronfeld 1919; Selz 1919; Stern 1919), Denmark (Ericksen 1927), Spain (Azon 1934), England (Burton and Reid 1924) and in Italy (the Carlinga cockpit, described in the U.S. Army Bulletin 1931).

This subject was reviewed after the last war by Dockary and Isaacs (1921), Gradenigo and Gemelli (1919), and by Perrin de Brichambaut (1921). Other tests for resistance to emotioual excitement apart from startle tests have been described by Camus (1919), Capek (1930) and Talenti (1929). The full scope of the tests described in these papers is not covered in this short abstract.

The difficulty which has arisen in compiling a suitable battery of tests is reflected in the wide scope of the literature and although there is now general agreement that some form of psychological testing is desirable, its form is difficult to define. One group of workers has stressed the importance of evaluating the whole personality. Rivers and Rippon (1920) used the method of personal interview upon accepted clinical psychiatric lines, but were not satisfied with the results. Talenti and Enzo de Meo (1940) advised very close observation both in the entrance examination and afterwards in the aviation school. Room (1941) has pointed out that the emotional response to an entrance examination may give a false impression of the candidate's capabilities and temperament. Archer (1939) advises a full psychiatric interview, with investigations of the candidate's past record and his family history, as well as assessment of the total personality, as well as circulation of a questionnaire to the candidate's school, similar to that employed by the Vocational Guidance Department of the National Institute of Industrial Psychology. Patient (1938) thinks that a very full assessment of the total personality, with special emphasis upon such qualities as cheerfulness, stability, self-reliance, aggressiveness, modesty, frankness, powers of co-operation and relaxation and so on, will favour more efficient selection. Poppen (1941) states that however objective the tests become, it is not feasible to eliminate the personal interview entirely. Carlson (1941) has used intelligence tests and finds that 20 per cent of candidates fall below the requirements of the U.S. Army Air Corps.

Another group of workers, many of whom have already been quoted, have used various forms of simple and complex tests of kinaesthetic ability and other objective methods of assessing the candidates' response to stimuli. These tests, most of them now of purely historic interest, have become increasingly complex, each addition being fresh evidence of the great defect of the method, that it takes no account of the total personality. Recently elaborations have been achieved which require the simultaneous performance of complex and inter-related actions calling for speed, judgment, dexterity and endurance. They are based upon the simpler co-ordinated pursuit metres of the Reid (1924) type, and as they evolve they approach closer to the actual conditions existing in an aeroplane cockpit. The use of still more elaborate batteries is in process, but the details have not yet been published.

The trend of this evolution of the tests supports the view of those (Birley 1920, Rivers and Rippon 1920, Talenti and Enzo de Meo 1940) who think that aptitude can only be efficiently demonstrated by trial, urging observation in the aviation school and in the air during the early stages of training. A more conservative, but obviously valid, observation by Thorndike (1919) and Birley (1919), is that even were the assessment of temperamental suitability for flying efficient, it does not necessarily reflect the airman's suitability for withstanding the stress of operational service.

From a survey of the literature it seems that although selection by psychological methods prevents acceptance of some candidates who are temperamentally unsuitable for flying, it does not seem possible by such methods to recognise those with a marked flying aptitude. This has been appreciated by many observers, including Anderson (1919), Birley (1920) and Rook (1939). This is to say that evaluation of the total personality in relation to Service flying either as a whole or by analysis of its components with special tests has value in rejecting the unsuitable but not in selecting those eminently suitable for flying training. This appears to be true however skilled the examiner or however detailed the examination. Burton and Rook (1939) followed the flying careers of 100 candidates, some of whom were somewhat below the acceptance level upon ordinary standards, but who were nevertheless allowed to train. They found that the proportion of failures to learn to fly was equal in the groups above and below the standard requirements.

(*d*) *Results of selection.*—The batteries of physical and psychological tests at present in use produce a very high rejection rate. All the reports published in the United States show a level of about 80 per cent. Benson (1937) made observations on 10,000 applicants, and found that the rejection rate had risen from 75·6 per cent in 1931 to 84 per cent in 1936. Of these 62·2 per cent were rejected for ocular defects, 19·4 per cent for medical reasons and 10 per cent for neuro-psychiatric causes. Even with this high rejection rate, selection is not adequate, for in 1933 although the rejection rate was 70 per cent, less than 40 per cent of those accepted completed training. Mashburn (1934), Gore and Lawton (1936) found that of 575 candidates examined at Maxwell Field in 1933–1935, 80 per cent were rejected, but even so only 84 of the 112 started primary flying training after the aviation school, and a mere 42 graduated as pilots. This is 7·3 per cent of the candidates. Nevertheless, selection has doubtless reduced inefficiency in air crews and as the great majority of accidents are due to pilot error (between 80 and 90 per cent, according to McFarland 1941) and not to mechanical or unavoidable natural causes, the reduction has great practical value. In the 1914–18 war the proportion of pilots grounded through psychological disorders was reduced from 90 per cent to 12 per cent after a system of selection had been adopted (Bauer 1926). With so many variable factors, such as modification in aircraft design, increased efficiency of instruments and ground control, together with added responsibility and strain, it is difficult to assess with any accuracy the value of selection for war flying by long-term observation, and the literature does not contain any data upon a long-term follow up of two groups of pilots selected and unselected, or selected under different conditions. Indeed, Mashburn (1939) has severely criticised the practical validity of many of the tests employed.

As Poppen (1941) observes, the trend of new examination methods is distinctly towards greater objectivity. This is, of course, highly desirable, but it results in rejection upon rigid criteria, so that the rejection rate of each speciality may be expected to rise. For instance, attention has recently been drawn (Bartlett and Carter 1941) to unsuspected cardiac defects in candidates, demonstrated by combined electro-cardiography, stethography and cardioscopy. Using the electro-encephalogram, Williams (1941) has shown that the proportion of abnormals in successful pilots is lower than in the normal healthy population and Thorner, Gibbs and Gibbs (1941) have found a relationship between efficient performance of pilots and characteristics in the normal electro-encephalogram.

The development of such methods of detecting abnormalities unrevealed by routine clinical examinations will naturally increase the rejection rate, and should lead to a point at which unfitness or potential unfitness in the selected candidates may reach a very low figure. It is evident, however, that this advance is made through rejection and not selection, so that more and more apparently unsuitable candidates who might in fact prove efficient pilots, are rejected. A point must be reached at which the practicability of this degree of selection has to be judged in relationship to the factors of supply and demand.

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CHAPTER II

USE AND ABUSE OF THE TERM 'FLYING STRESS'

by

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During the war of 1914–18 it became apparent that flying personnel might show inefficiency or loss of confidence in the air without evidence of any known physical disease to account for these phenomena. The problem of wastage from this source became important and investigations into the nature and causes of such conditions were undertaken. The approach in the first place was physiological and resulted in the tests for physical efficiency devised by Flack and reported in " Tests for Flying Efficiency and Flying Strain " (1920). From this report it appears that although psychological factors might be evident in the aetiology of the condition, they were taken into account only in so far as they might be presumed to have caused, or contributed to, a state of nervous exhaustion, other factors concerned being the effects of altitude and physical fatigue. All these factors together were summed up as flying strain or flying stress, and by a natural but inexact transition the symptoms attributed to these factors were called collectively flying stress. Thus on the same page of Flack's report we find reference to " cases who have broken down through flying stress " and to a state in which " flying stress has markedly supervened."

Birley's report " Temperament and Service flying " (1920) indicates that a symptom picture of psychological disturbance psychologically determined was already recognised and that the term temperamental unfitness was in use to describe this. It appears that this term was employed to include both those whose inefficiency or lack of confidence had appeared without any crash or unpleasant experience, and those who had shown no evidence of inefficiency or lack of confidence until after such an experience or after a considerable period of operational flying. Birley observed that in the former group as compared with the latter the tests for physical efficiency were generally satisfactorily passed; and that there was frequently a positive family, or personal, history of neuropathy. He concluded that temperamental unfitness and physical unfitness were closely allied, and that in the temperamentally unfit the unfitness " lies largely in an undue susceptibility to mental shock." Individual susceptibility of this kind therefore was a factor which must be taken into account as well as the strain of flying. Birley concluded his report with the suggestion " that certain conditions which are at present called flying stress could more appropriately be designated by the title flying distress. He implied presumably that whereas the title flying stress was applicable to a state caused by the excessive strain of flying duties, it should not be applied to a state in which constitutional defect, not excessive strain, was the cause.

Other terms which came into use in the early days of flying were aviation neurasthenia and aero-neurosis. The latter was used by Anderson (1919) to include any type of functional nervous disorder brought on by flying. He and Gotch (who was responsible for the section on the aeroneurosis of war flying) include under aeroneurosis conditions of tiredness or staleness, toxic state, oxygen want, air sickness, heterophoria and constitutional psychopathy, as well as those in whom " the breakdown as regards flying has a purely mental origin." They admit, however, that the vast majority of cases fall into the last group.

It is evident that nomenclature was already proving a difficult problem, and that the different meanings attached to new terms had resulted in confusion. The reasons for this are not far to seek. At that time aviation was in its infancy and little was known of the effects of altitude and gravity upon the human body. When flying personnel developed functional disorder of any kind it was at once assumed that this was a physical effect of the new and unknown factors which were called flying strain or flying stress. At the same time and for similar reasons, soldiers who developed functional nervous disorder after exposure to the effects of high explosives of a weight and force never before experienced were assumed to be suffering from the physical effect of blast or shell shock. This would not have mattered much if flying stress and shell shock had continued to be used to describe new *causes* of functional disorder, for critical examination of the clinical syndromes resulting from these causes would fairly soon have revealed that while some of these syndromes were attributable to physical causes, as for example the syndrome of anoxia from flying, or blast concussion from shell explosion, the vast majority were due to psychological causes. When this had been appreciated, as it was much later, it would soon have been evident that the syndromes of psychological causation were in no respect different from the neuroses of civil life and were classifiable under existing headings. Unfortunately both flying stress and shell shock came to be used to describe syndromes instead of causes, and the result in the case of shell shock is well known. It was assumed that a new clinical syndrome or disease had arisen attributable to shell blast and that anyone who had been exposed to shell fire might develop this new disease. Shell shock became a diagnosis which ranked for attributability with gun-shot wound, and implied in just the same way as a wound, a purely external cause. Flying stress also became a diagnosis with similar implications and we have noted Birley's uneasiness at finding it so used in cases where it was evident to him that the true cause of the nervous disorder observed was not the stress of flying but "undue susceptibility to mental shock."

After the war, the War Office Committee of Enquiry into Shell Shock (1922) published its detailed and critical review of the evidence given on the subject by medical and executive officers. The opening paragraph of the recommendations made by that committee reads: "The term shell-shock should be eliminated from official nomenclature, the disorders hitherto included under this heading being designated by the recognised medical terms for these conditions." Medical and executive officers of the Royal Air Force gave evidence before the committee and described, as the result of terrifying experiences in the air, symptoms which differed in no material respect from those observed in soldiers, and were in fact called shell-shock by those who described them. Nowhere in their evidence have I been able to find the term flying stress. This seems tacit admission that flying stress was merely a synonym for shell-shock and that the recommendation quoted above was as much applicable to the former as the latter. Nevertheless flying stress as a diagnostic term appears to have survived in the Royal Air Force with the implication that the strain of flying duties could produce a clinical syndrome sui generis.

This view received strong support from Armstrong (1936, 1939) who, under the title aero-neurosis, for which he accepts flying stress as a synonym, described "a special form of functional psychoneurosis appearing in airplane pilots." This he distinguishes from all other neuroses as "an entity seen only among aviators." Its main features are described as gastric distress, nervous irritability, fatigue of the higher voluntary mental centres, insomnia and increased motor activity. It is attributed primarily to the stress of flying, the symptoms only developing after several years. Among exciting causes a variety of factors are considered, both physical and psychological. The list appears to include every possible ill with which the aviator may be beset, from carbon monoxide poisoning and centrifugal force at one end of the scale to chronic anxiety and psychic trauma at the other. The only effective treatment in the author's experience has been removal from flying duties. Return to flying after improvement is usually followed sooner or later by relapse. In discussing pathogenesis the author concludes that a psychogenic basis provides the best explanation and proceeds to describe the mental state engendered by emotional conflict together with its associated bodily reactions. Unfortunately the author appears to be unacquainted with psychiatric terminology and definition as used to-day, for he states that in aero-neurosis " there are no doubts or hesitations as in psychasthenia, no quitting under the guise of organic disability as in neurasthenia, no infantile reactions of hysteria, or none of the obsessions or mental manias of the anxiety state." Reference to any textbook of psychiatry published within the last five years will reveal that the author's understanding of what is meant by these terms is imperfect.

Critical review fails to convince the psychiatric reader of Armstrong's claim that what he describes is a new disease, or that it is a disease confined to aviators. It appears to be only our old friend shell-shock in a new disguise, in fact an anxiety state, complicated as often by symptoms of the kind covered in modern psychiatric parlance by the term neurasthenia—a combination well known in people who have had nothing to do either with aviation or war.

A communication from Dill and Ivy (1941) to the Committee on Aviation Medicine of the National Research Council, U.S.A., deals with another supposedly new disorder among flying personnel designated acute pilot's fatigue The authors report that they have seen no evidence showing that the condition actually exists, but proceed to consider in some detail the factors which might contribute to such condition, such as general physical unfitness, emotional stress of various kinds, CO poisoning, cold and the effects of altitude. All these are well known, but there has as yet been no proof from the experience gained in this war that any clinical syndrome may result from each or all of these factors, which cannot be described in existing terms.

The tendency to invent new terms for neurosis in flying personnel is due largely to the desire, especially on the executive side, to avoid for the man who has often achieved much, or at any rate has done his best, any appellation which would class him as 'neurotic.' Fortunately the classification of all mental disorder in terms of reaction types now almost universally adopted in this country will allow us to give a name to any psychological disorder of the kind which might be included under flying stress, aero-neurosis, acute pilot's fatigue, and for that matter shell-shock, without introducing the term 'neurosis.'

The following classification is now in use for psychological disorder in flying personnel for the Royal Air Force :—

Anxiety
Depression
Elation
Fatigue syndrome
Hysteria
Obsessional
Schizophrenia
Organic acute
Organic chronic

It will be observed that a concession has been made to popular prejudice by the insertion of fatigue syndrome which replaces the term neurasthenia of current psychiatric usage. This is considered justifiable provided that it is strictly understood that fatigue syndrome means a syndrome in which sensations of fatigue, or complaint of undue fatiguability are the prominent symptoms, and that it does not mean a syndrome caused by fatigue. This point is laboured to avoid possible confusion between effects and causes. The fatigue syndrome in some cases is due mainly to physical exhaustion, in others (probably more) it is mainly due to emotional conflict; it is not infrequently due to a combination of both, as well as to other causes such as oxygen want, or the after effects of infective illness.

It is submitted, therefore, that there is no justification for the term flying stress as a diagnostic heading, and that such usage might well have harmful effects of the kind which attended the use of shell-shock, of which the Committee of Enquiry reported that it " was wholly misleading but unfortunately its use had been established and the harm was already done." On the other hand flying stress might usefully be employed in its original sense to designate the especial strains or stresses to which flying personnel are exposed. It might well in this sense be used in a quantitative way to denote the amount of strain to which a man had been put. Thus a man who had had a crash without injury to himself or others might be said to have been exposed to slight flying stress; a man who had had a similar crash with painful injury to himself or fatal injury to others, to moderate flying stress and so on. Such estimates especially as recorded by commanding officers would be of considerable value to the medical branch if the man subsequently became ill with psychological disorder. There will still be problems of flying stress for discussion by executive and medical officers: for example, how much flying stress can the average man stand without breaking down; what are the most important elements in flying stress for fighter, bomber and reconnaissance personnel; what psychological types stand up to flying stress best or worst? But it should be understood once and for all that flying stress is that which happens *to* the man, not that which happens *in* him: it is a set of causes, not a set of symptoms.

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CHAPTER III

A SERIES OF CASES WITH PSYCHOLOGICAL DISORDER EXAMINED IN RELATION TO THE PROBLEMS OF SELECTION OF FLYING PERSONNEL

by

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1. Material

In relation to the problem of selection of flying personnel I have examined my notes on 100 consecutive cases referred to Central Medical Board on account of psychological disorder. These cases were of course a selected group in so far as they had all developed sufficient evidence of psychological disorder to cause them to be referred for a consultant's opinion. They were unselected in so far as they were 100 taken in alphabetical order from a group seen between October 1940 and November 1941 without reference to the duration of flying experience, position in aircraft or other factors. It may, therefore, be worth recording some of these points for the series as a whole.

(*a*) *Age.*—The average age for pilots was 25·57 years, the extremes being 19 and 37 : the average age for other members of air crew was 25·24 years, the extremes being 19 and 36.

(*b*) *Rank.*—55 were commissioned and 45 non-commissioned.

(*c*) *Category in crew.*—71 were pilots, 8 observers, 12 wireless operators-air gunners and 9 air gunners.

(*d*) *Duties.*—65 of the subjects had been engaged upon operational duties, as follows :—

24 Night bombers
12 Day bombers
18 Fighters
2 Coastal flying boats
4 Coastal General Reconnaissance
2 Coastal fighters
1 Night fighter
2 Army Co-operation

Of the remainder, 29 were under training, 5 were instructors and one had completed his training but not begun operational duties.

(*e*) *Flying hours.*—The total number of flying hours for 71 pilots was 52,455, with an average of 738·8 hours. For other than pilots, the total was 8,462 hours, with an average of 291·79 hours. The total number of flying hours for 34 personnel (pilots and crews) with no operational experience was 22,215 hours, with an average of 653·37 hours. For 35 with an operational tour more than half completed the total was 20,680 hours, with an average of 590·85 hours. The larger average of flying hours for the group with no operational flying is due to the fact that this group includes 5 instructors with a total of 11,100 hours, and 4 others with a total of 6,050 hours, mostly pre-war, who broke down before beginning operational duties. When these are subtracted the average flying hours for the remainder of the non-operational group is 202·6 hours.

2. Method of case examination

The method of examination was that of the ordinary routine followed in such cases in clinical practice. The patient was first encouraged to state in what respects he felt unwell or uneasy. When it became apparent that his symptoms were of a nervous type enquiry was made as to the existence of any such disorder in other members of his family. An outline was then obtained of his life history from childhood up to the time he entered upon his flying career, with special reference to school achievement in work and games, and jobs held. A note was made of any previous illness or injury, and especially of any evidence of timidity, general or specific, lack of aggressiveness, liability to depression or anxiety, obsessional trends or psychopathic traits. The history of the flying career was next taken with particular attention to the reasons for volunteering for flying duties and to any unpleasant experiences or difficulties since these duties had been commenced. The date of onset of symptoms complained of was then determined in relation to flying experience, or other possible causal factors, such as physical illness or private worries. A brief examination of the nervous system completed the examination. Notes were made of any abnormalities observed in the mental state. The duration of the examination was limited to three quarters of an hour. No attempt was made to obtain answers to a set of questions such as that employed by Air Commodore R. D. Gillespie, though many of the points included in his questionnaire were covered in taking the history. It was considered more profitable in the time available to get the patient talking, to extract as much information as possible upon special points in the course of conversation, and to obtain a clinical impression, rather than a formal score.

3. Analysis of clinical data

Examination of the material suggested that it would most profitably be considered for the purpose in hand in relation to the amount of operational work achieved. Two groups of cases were therefore first selected : A, 34 men who had not served in operational units, and B, 35 men who had completed more than half an operational tour or had in the course of operations suffered severe or exceptional stress in a shorter time. In each group two sets of facts were looked for, first those which in the observer's opinion provided evidence of a predisposition to breakdown, second those which indicated external causes for the breakdown (i.e. psychological or physiological stress, whether from flying duties or other sources). When predisposition was evident an attempt was made in the light of the clinical impression recorded, to decide whether the observer, as a result of a single clinical examination, would have rejected the individual for air crew duties. If so, the predisposition was noted as severe, if not, as mild. When the external causes included stress of flying duties, the degree of stress was roughly estimated against normal flying experience as nil, slight, moderate, severe, or exceptional.

Group A : 34 men with no operational hours to their credit

Instructors.—Five of the group would probably never have been posted to operational units, but would have continued to be employed as instructors. All had more than 1,000 hours to their credit. They form a small group which is outside the main topic of discussion but deserves comment. One, aged 27, with 3,500 hours of commercial flying on commencing Service training could not adapt himself to aerobatics, which he felt were unsafe. One was stale after nearly 2,000 hours instructing and had domestic worries. One in 1,700 hours flying had once had to bale-out, had had a crash without injury, subsequently a minor head injury in a motor accident, and had recently experienced a loss of a co-instructor killed in a crash. In none of these three cases was there any evidence of predisposition to psychological disorder.

Of the two others, one was liable to depressive moods, with an uncle subject to recurrent depressive illness, and was worried over the fact that his wife was German born. The other, with 2,900 hours (father had a history of breakdown), had always been moody and irritable, disliked instructing and had recently had to cancel his approaching marriage as his fiancee had developed tuberculosis. In these two cases therefore there was evidence of predisposition, but rated as of mild degree, i.e. it would not have warranted rejection.

Men (29) *under training, or with their training completed, who would ordinarily have been expected to proceed to operational duties*

(*a*) Four in whom no predisposition could be found: in every case there had been some degree of stress. In three cases it was graded slight, and in one moderate. For the sake of indicating at this stage the grounds taken for assessment of stress, details will be given.

Case 50 : Symptoms began after witnessing a fatal crash. Flying stress slight.

Case 37 : Suffered minor injuries in a crash, including concussion. Nervousness of flying began after this. Flying stress slight.

Case 54 : Crash with minor injuries. Flying stress slight.

Cast 56 : A pilot who crashed with minor injuries to himself, W/Op. killed. Flying stress moderate.

(*b*) Nine in whom a mild degree of predisposition was found: in three of these cases there had been no unpleasant experience whatever ; in three others there had been some unpleasant experience, but none beyond the average (two had had crashes without injury to self or others, one had witnessed a similar crash at a time when he was anxious about his wife who was pregnant) ; the remaining three had all suffered some degree of flying stress, two mild, one severe. The last case was that of a W/Op.A.G. who was the sole survivor of a Beaufort crash and learned that his best friend had been killed in a similar crash on the same day. An example of this group is the following :—

Case 3 : P/O A. Pilot aged 28. u/t fighter, flying hours 1,200.

Complaints : Defective hearing and vision : loss of weight : awfully nervous, jumpy and irritable : "if a door slams, my heart pounds : " difficulty in concentration.

Family history : Mother has spells of depression and nervousness, for which she has to go to bed under doctor's orders.

Personal history : Apt to get depressed and irritable for a day or two if things go wrong. Apart from this no abnormal traits. Married seven years, no children.

Flying history : Took up flying as a career in U.S.A. after leaving college, and became a commercial pilot. Was a careful pilot, did over 1,000 hours with no crashes or unpleasant experience. Two of his friends volunteered for the Eagle Squadron, and he thought he would go too. He was influenced by the fact that his wife was English.

Clinical history : After a few hours flying in Masters, on coming in to land his brakes locked and he turned over. He was momentarily unconscious, suffered a cut scalp (no stitch needed) and multiple contusions. He was put to bed in sick quarters with a hypnotic, but did not sleep. The next night he slept better but had a slight headache for a day or two. On returning to flying a fortnight after the accident he found he had lost his nerve. He had to drive himself to fly. Nevertheless, he continued for two months having then completed 70 hours solo in this type and then as he had not recovered his confidence, reported sick. The ophthahlmic and E.N.T. reports revealed no cause for his symptoms. He stated that he felt incapable of continuing with flying duties. According to his own statement he had lost 50 pounds in weight since his accident. He was marked A4hBh for three months permanently unfit A1. Six weeks later he was seen again as he felt unable to cope with ground duties. The sight of aeroplanes upset him. Three of his friends had been killed in crashes. He could not concentrate on his job, he was clearly anxious to return home. He was considered permanently unfit for flying, disability non-attributable.

Comment : The main evidences of predisposition in this case were in the family history and his reasons for joining the R.A.F. The predisposition however was not considered to be of more than mild degree. Flying stress was rated as slight. There was no evidence of head injury of a degree which could be considered important as a causal factor. The impression gained was that he was an individual of poor morale, and not a strong character.

(*c*) Sixteen in whom a severe degree of predisposition was found: in 13 of these there had been no unpleasant experience whatever. They had broken down in the ordinary course of flying training. In one, symptoms developed after a single crash without injury to self or others. Flying stress nil. The other two were deemed to have suffered slight flying stress (one crash landed without injury to self or others after having been lost for some time in fog; the other had witnessed two fatal crashes). An example of this group is the following :—

Case 49 : Sgt. G. Pilot, aged 23. Flying hours 190. Operational hours nil.

Complaints: Headache (especially when flying), depression and difficulty in concentration.

Family history : Father always an anxious type had a nervous breakdown five years ago : he ' went to pieces ' and was off work under medical care for several weeks.

Personal history : At the age of nine he was away from school for six months owing to 'a mania for tapping things and screwing his eyes up'. He recovered from this, but always had a tendency to worry about small things. After school he obtained a post as assistant cashier. He worried a good deal about his future. Married two years. No children.

Flying history : He was keen to fly and joined the V.R. before the war. He had no special difficulties or unpleasant experiences in training.

Clinical history : For the past year he had been anxious and unhappy without at first any special cause. He had difficulty in getting off to sleep. He envied his friends who were carefree. He wanted to feel that he was doing something worth while, but when he got on to Hudsons the noise got on his nerves. He found himself obliged to think of this and could not give his attention to the job. After first reporting sick he was operated on for a deviated nasal septum. It was after this that his other symptoms became associated with headache. Marked permanently unfit air crew.

Comment : The incidence of predisposition in the family and personal history is clear and he would have been unhesitatingly rejected on a single clinical examination. Flying stress, nil.

Group B : Thirty-five men who had completed more than half an operational tour or who had in the course of operations suffered severe or exceptional stress in a shorter time

(*a*) Eight cases in which no predisposition could be found: the incidence of stress was as follows :—

Flying stress moderate	..	..	..	3 cases
,, ,, severe	..	..	..	4 cases
,, ,, exceptional	..	..	..	1 case

This sub-group included one D.F.C. and two D.F.Ms.

Brief examples are as follows :—

Case 46 : F/Lt. G. D.F.C. Pilot, aged 23. Flying hours 600. 25 sorties on day bombers. Heavy casualties in Squadron. After completion of his tour felt tired. Was posted to an O.T.U. as instructor. There he had an operation for chronic appendicitis. While he was convalescent his baby died and he became depressed and sleepless. He was grounded for two months, and thereafter had four months non-operational flying. At the end of this time though he still appeared somewhat tense and restless, he considered himself as fit, and was passed fit for full flying.
He described his mother as a nervous person, but she had never been under medical care on this account. There was no other history of psychological disorder in the family. He, himself, had had at the age of 16 a disturbance of some kind in the night, which from the story might possibly have been epileptic or an attack of somnambulism. There was no other evidence of personal abnormality.

Comment : It was considered that there was no definite evidence of predisposition in this case. Flying stress was rated as moderate.

Case 20 : F/Lt. C. Pilot, aged 24. Flying hours 590. Operational hours 270 in fighters. During the Battle of Britain claimed 4 enemy aircraft. Was subsequently on Defiants, in which he was never quite happy and had 5 crash landings but without injury to himself. After this he was knocked over by the blast of a bomb during an attack on his airfield, sustained a bruise on his forehead and was momentarily unconscious. After this he became nervous, depressed, restless and irritable and completely lost his confidence for flying. He failed to recover it after four months rest from flying duties. A paternal uncle had periodic mental breakdowns with recovery. There was no other abnormality in the family history, nor any abnormality in his own life history.

Comment : Although the story of his uncle's illness taken together with his own was suggestive of an inherited liability, the rule taken for purposes of the present analysis has been not to include mental disorder in second degree relatives unless supported by other evidence of predisposition. Predisposition, therefore, was considered to be absent. Flying stress was rated as moderate, but the addition of the bombing made the total stress severe.

Case 88 : Sgt. M., D.F.M. Pilot, aged 21. Flying hours 400. 13 sorties in night-bombers. On last trip in mid-November was shot down into sea and was 16 hours with the rest of the crew in dinghy. Was awarded D.F.M. as captain of aircraft on this trip. Afterwards visualised the episode repeatedly and could not sleep, but in two-and-a-half months he recovered and passed fit full flying duties. The only suggestion of predisposition was the story that one of his brothers had been nervous after an accident.

Comment : Predisposition was considered nil. Flying stress severe.

Case 25 : F/O C. Fighter pilot, aged 25. Flying hours 400. More than 30 combats, shot down into North Sea in February, 1940, and picked up after swimming for 20 minutes. In June, 1940, shot down in flames over Dunkirk, burnt on face (not badly). In September, 1940, shot down in flames over Kent, baled out, moderately burned face and hands. After his first experience he had nightmares for some time ; after the second he felt shaky but concealed his nervousness. After the third he began to have repeated imperative visualisation of one or other of his experiences, and confessed himself terrified of being burned again.

Comment : No suggestion of predisposition could be found in this case. Flying stress was exceptional.

(*b*) Nineteen cases in which a mild degree of predisposition was found : the incidence of stress was as follows :—

Flying stress nil	1 case
,, ,, slight	1 case
,, ,, moderate	11 cases
,, ,, severe	5 cases
,, ,, exceptional	1 case

This sub-group included 1 D.F.C. and Bar, 2 D.F.Cs., 3 D.F.Ms. and 1 George Medal. Two cases may be given as examples of this group :—

Case 62 : Sgt. K., D.F.M. Pilot, aged 25. Flying hours 700. 30 sorties on night-bombers.

Complaints : Anxiety and loss of confidence. " There is a continual battle between what I see on the flying panel and my other senses. I am afraid I shall not be able to control my natural impulses in bumpy weather. I want to ignore the instruments and fly by what I feel."

Family history : His father was said to be self-conscious and ill at ease with strangers.

Personal history : He was born and educated in the country. After school he was employed as a clerk. He came to work in London at the age of 21 and did not like the crowds. " I wanted to get away into the open and the fields away from them." He disliked travelling in the tubes, having an uncomfortable feeling of being enclosed. He was keen on amateur dramatics, but suffered so badly from stage fright that it was a torture. Knowing that it was good for him he forced himself to take big parts to get over his nerves. He was always mildly obsessional, unhappy unless all his things were in the right place and his correspondence up to date, and liking to have each stage of a job properly tidied up before he went on to the next.

Flying history : He joined the R.A.F. because he wanted to fly. After Blenheims he went to Hampdens and on his first flight got into a stabilised yaw, pulling out at 50 feet. He was shaken by this but got over it in a few days. He then did 13 sorties as second pilot in a Hampden and completed a first pilot's course of instruction.
Clinical history : His first trip as first pilot was to Cologne, all instrument flying. He felt tired, lost confidence in himself, became anxious, and reported sick. He was seen by a neuro-psychiatrist, who observed that he had only had 7 days' leave in 17 months. He was given 14 days' leave, came back, completed the operational tour and was awarded the D.F.M. He practised instrument flying all he could by going into clouds and after a few trips got over his loss of confidence.

Comment : Predisposition was assessed as mild. Flying stress was moderate. Fatigue and staleness had played an important part.

Case 27 : P/O D. Pilot. George Medal. Aged 27. Flying hours 240. Operational hours 100 on day-bombers.

Complaints : Loss of confidence in flying : can't sleep if he knows he has got to go in an aeroplane.

Family history : Nothing abnormal.

Personal history : His father died young. He was brought up, with two sisters, ' by a lot of women ' and thinks he was pampered as a boy. At school he could not take chaffing, and was sensitive and depressed if left out of things. He was liable to moods of depression if things went wrong. He went into an office, but disliked the indoor life and was restless.

Flying history : He did well during training, but was dissatisfied with himself. He had the idea that instead of having ability he had luck. His instructor told him he had a sense of inferiority. He had one crash night flying in training, and subsequently was never quite confident when night flying. He was posted with friends to an operational squadron with only 13 hours' experience on twin-engined aircraft, and felt conscious of his inexperience. In the first month with the squadron three of his friends were killed owing, as he thought, to inexperience.

Clinical history : He was wounded by ack-ack in the thigh and ankle in an attack on the Danish coast but flew his aircraft home. He tried to jettison his bombs but one failed to disengage and exploded on landing. He was awarded the G.M. for getting his air gunner out of the burning wreckage. While in hospital he became shaky and depressed, and as his wounds healed was very unhappy at the thought of flying again. Two months after his wound he was passed fit for full flying duties, and at that time concealed his apprehension. On returning to his unit he was given dual but had to force himself to fly. He was then put on to night flying, but couldn't land and his instructor refused to let him go solo. After this he did two long daylight sweeps but, before flights, waiting was a torture. He then reported sick. On examination he was restless, tense and self-reproachful. " I feel I'm yellow, and a disgrace to the squadron." He was given a ground job for three months, and afterwards marked limited to light aircraft at home only, but four months later had not flown and was doing an administrative job. He was still anxious and self-reproachful.

Comment : Predisposition was assessed as mild, flying stress as severe.

(*c*) Eight cases in which a severe degree of predisposition was found: in this sub-group, which included one D.F.M., the incidence of stress was as follows :—

Flying stress slight	.. .. ..	2 cases
,, ,, moderate	.. .. ..	3 cases
,, ,, severe	.. .. ..	3 cases

Case 55 : F/O H. Fighter pilot, aged 29. Flying hours 500. Operational hours 150. Hurricanes.

Complaints : Insomnia, depression, loss of confidence in ability to fly.

Family history : Father was a bad sleeper and conscientious to an abnormal degree.

Personal history : He was solitary as a child, but reasonably happy at his preparatory school and at Eton. He then tried his hand as a newspaper reporter and subsequently had a post as a private secretary. Four years ago when anxious over his work, he suffered from insomnia with subsequent recurrence under similar circumstances. The insomnia was then, as now, related to obsessional tendencies. In June, 1939, after failing to fulfil his hope of becoming engaged he had a severe bout of insomnia, being sometimes without sleep for several nights. For this he had treatment, and on medical advice took a three-months holiday, from which he was recalled to active service. He married in November, 1939.

Flying history : He joined the Auxiliary Air Force in 1936, enjoyed his flying and had no difficulties or unpleasant experience. He flew throughout the Battle of Britain in Hurricanes, claimed to have shot down four enemy aircraft and was twice shot down himself. During the earlier part of this period he was sleeping well and experienced no more than the average affective reaction.

Clinical history : He was then made a flight commander and slept badly at the dispersal hut, sometimes getting no sleep at all. He became anxious about his sleep and began to have retrospective anxiety about his combats. He was relieved of his flight but lost confidence in his ability to fly, and was posted to an O.T.U. There he crashed a Spitfire and subsequently reported sick. " I would like to fly, but I only hope it won't upset my sleep. You can do any other job whether you've slept or not, but not flying. I think of this in the night." He was admitted to Torquay, where he remained under treatment for six weeks. He was then marked A1hBh, one hour flight, not above 10,000 feet, for 6 months, but was given a ground job. Six months later he reported periodic insomnia—about once in ten days. He was unable to get off to sleep owing to obsessional thoughts, for example, whether he had forgotten to do something during the day, or whether, if he were going away, he would sleep in strange surroundings. He had done one solo flight of 1½ hours, but did not like it because he had to get back within a specified time. He did not think he could ever get back to operational flying. He was marked permanently unfit for flying duties and for overseas.

Comment : Predisposition and flying stress were assessed as severe.

4. Discussion

The value of these observations is limited first by the fact that all these individuals had already developed psychological disorder before they were first seen. As it is probably true that in *every* case of psychological disorder there are two groups of factors, the one internal (predisposition), the other external (stress), the observer must necessarily be prejudiced in favour of finding evidence of both. With regard to predisposition it must be admitted that persistent enquiry in most people will reveal some imperfection in the family or personal history of a kind which may be regarded as a possible factor in the causation of breakdown. Such a discovery does not necessarily mean that the imperfections revealed have acted causally in the breakdown which has occurred, for there is a great variety in predisposing factors and an equal variety in the factors of external stress. Breakdown may be due to a chance combination of a particular set of the one with a particular set of the other. What kind of predisposition, what kind of stress and what particular combinations of each are important in causing breakdown in flying personnel are questions which will be considered in further reports.

With regard to flying stress it may be questioned whether the attempt to evaluate it on a scale such as has been used here is of any value at all, when one considers all the factors which may be operative. What matters is not so much what happens to the man as the circumstances of the happening, both external and internal. This will be evident from some of the case records quoted.

The assessment of predisposition and stress in the cases under review has been made with full recognition of these difficulties. It remains to be seen whether anything of possible value emerges from it. It is of interest to note that the proportion of cases showing no predisposition in the non-operational group was 4 out of 29 as compared with 8 out of 35 in the operational group. Sixteen of the non-operational showed severe predisposition as compared with 8 of the operational group.

The incidence of flying stress in the operational group is inevitably greater than in the non-operational. Within the non-operational group however there is a relationship between predisposition and stress which does appear to be significant. In this group 14 of 16 individuals with severe predisposition broke down with no stress, as compared with 6 out of 9 with mild predisposition, and none out of 4 with no predisposition. There is a trend therefore suggesting an inverse relationship between stress and predisposition. But when we consider the operational group the trend is less evident. Five out of 8 individuals with severe predisposition broke down with moderate stress or less, as compared with 13 out of 19 with mild predisposition, and 3 out of 8 with no predisposition. Although none of these figures is large, their general trends are interesting.

The difference between the two groups of cases requires explanation. It is possibly to be found in the much greater opportunity in the operational group, owing to the variety of external causes, of that chance matching of specific stress with specific predisposition which may cause a breakdown in any individual without relation to his sum total of predisposition as judged by clinical standards. On the whole it appears that predisposition assessed by the method described in this report is, within limits, an indication of the probability of psychological disorder developing under non-operational conditions, but is of doubtful value in those who have completed half an operational tour.

If the 24 individuals assessed as showing severe predisposition had been rejected as candidates for air crew what would the Service have gained and lost ? It would have gained by saving training 16 individuals with a total of 7,420 flying hours, who proved incapable of making any contribution to the operational effort. It would have lost by the rejection of eight who had contributed as follows :—

Case 12 : Pilot. Coastal G.R. 300 operational hours. 1 M.E. 109 destroyed. No likelihood of return to operational flying.

Case 17 : Airgunner. Coastal G.R. 300 operational hours. Prospect of return to operational flying good.

Case 31 : Pilot. Night bomber. 28 sorties (5 from Britain, 23 from Middle East). Prospect of return to operational flying doubtful.

Case 41 : Pilot. Night bomber. 14 sorties. No prospect of return to operational flying.

Case 55 : Pilot. Fighter. 150 hours. 4 enemy aircraft claimed. No prospect of return to operational flying.

Case 71 : Observer. Night bomber. 20 sorties. No prospect of return to operational flying.

Case 73 : Airgunner. Night bomber. 19 sorties. Little prospect of return to operational flying.

Case 83 : Observer. Day bomber. 100 hours. D.F.M. No prospect of return to operational flying.

These contributions have to be discounted by the adverse effect upon the morale of others of psychological breakdown, especially if it occurs before the end of an operational tour. It would therefore seem possible that rejection of all these individuals might have shown a balance on the profit side of the account. On the debit side we have to allow for the possibility that other personnel still engaged on operatioual flying would have shown a similar predisposition and would therefore by the same criteria have been rejected. Further research must determine this question.

If those with mild predisposition had been rejected the profit and loss account would have shown a quite different balance. Nine individuals would have been rejected who proved incapable of achieving operational duties, but of these one might have done so had he not had the misfortune to suffer severe stress during training. In return for this, 19 would have been lost to the Service who had completed more than half an operational tour, of whom seven had won decorations. In 6 of these 19 there was a good prospect of eventual return to operational flying.

4. Summary

(1) The records of 100 unselected cases seen by the writer at No. 1 Central Medical Board for psychological disorder have been examined, and data as to age, rank, crew category, duties and flying hours tabulated.

(2) The method of clinical examination is described.

Cases have been selected for detailed analysis: those with no operational hours (34) and those with an operational tour more than half completed (35).

(3) In each group an attempt has been made to assess predisposition and stress.

(4) It is claimed that there is a relation between predisposition, as estimated by clinical examination, and stress, such that in the non-operational group the probability of psychological breakdown under a specified degree of stress may within certain limits be forecast.

(5) If a severe degree of predisposition as assessed by this method were taken as a cause for rejection, more than half of those who broke down before reaching operational squadrons would have been thus rejected, but at the same time nearly a quarter of those who completed more than half an operational tour would have been rejected.

(6) If a mild degree of predisposition were taken as ground for rejection, 25 out of 29 of a non-operational group would have been rejected, and 27 out of 35 of the operational group. Eight of these 27 had been awarded decorations.

(7) The practical value of a single neuro-psychiatric examination in the selection of flying personnel is discussed.

Note.—Chapters IV, V and VI relate to the problem of neurosis in air crews of Bomber, Fighter and Coastal Commands. These reports were based upon a personal canvass of the views of executive and medical officers who were in intimate contact with the problem as it affected air crews on their stations. The method used is fully explained in the preamble to Chapter IV, which concerns Bomber Command. The reports were for internal reasons submitted independently to each Command. They all had much the same form and it would therefore be tedious to reproduce all three in extenso, so the compromise has been adopted of reproducing one of the original reports in full, and then describing how the other two differed from it. The Bomber Command report has been selected as the prototype because the psychiatric casualties in that command were so much higher than in the others, both in actual numbers and in incidence (*see* Chapters VII, VIII, IX), that the problem of the psychological care of flying personnel was more urgent there. Special aspects of the subject which were encountered in Fighter and Coastal Commands are described and are related to experiences in Bomber Command in Chapters V and VI.

CHAPTER IV

PERSONAL INVESTIGATION OF PSYCHOLOGICAL DISORDERS IN FLYING PERSONNEL OF BOMBER COMMAND

by

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Introduction

1. Purpose

The purpose of this investigation, as defined by the Director-General of Medical Services, was " to gain definite evidence as to the incidence and causes of flying stress and to ensure that our knowledge of these matters is brought up to date and kept up with current operational experience." In Chapter IX is an interim report upon the incidence based on data obtained from the Central Registry of cases of psychological disorder in flying personnel. The present report is mainly concerned with flying stress and the symptoms which may result from it. Flying stress represents the sum of all those factors which constitute the mental and physical strain of flying under war conditions. The effects of this load upon a man vary in relation to its weight and to the mental and physical stamina of the individual. When the load is too heavy for a man to carry, its effects are revealed by signs of fatigue, anxiety, or inefficiency, and in other ways which will be examined in some detail. It should be clearly understood that the term flying stress is not used by us to describe these ill-effects but as a synonym for the load or strain of war flying. Unfortunately, flying stress has been loosely used in some quarters to cover the effects of overloading. In order to avoid any confusion which might arise from this misuse, we shall throughout speak of the *Load* and the *Signs*, the former being equivalent to flying stress and the latter to the effects of flying stress.

2. Method of collecting evidence

The authors separately visited representative stations in each operational group and sought information from Station Commanders, Squadron Commanders and Station and Squadron Medical Officers. The interview was, with few exceptions, conducted privately and made as informal as possible, and occupied a half to one hour. It was explained that the Director-General of Medical Services wished to bring the instruction of junior medical officers up to date with current operational experience and that as the unit medical officers could not share this experience it was essential to interrogate general duty officers who were concerned with the leadership, training and care of flying personnel. The knowledge thus gained would be used to help junior medical officers to prepare themselves to advise or assist Squadron Commanders when asked to do so.

After this explanation, two broad questions were proposed. " What are the things which get people down ? " and " How do you tell when a man has had enough ? " Leading questions were then used to obtain information on subjects which from experience had been found worthy of discussion. Longhand notes were made of the replies to these questions, and of any other relevant material, and full reports of the interview were made as soon as possible.

In giving us their facts and opinions the officers were primarily concerned with the problem of impairment of operational efficiency and the effective loss of flying personnel resulting from flying stress. Both in their unsolicited expressions and in their replies to questions, some of them raised issues which are outside the bounds of medical opinion. This naturally occurred more often in the case of general duty officers whose outlook was practical and comprehensive. Views were expressed for example on the duties of the squadron commander, the form of relief employment and the value of discipline. These views are presented objectively in exactly the same way as those covering more orthodox medical subjects, but unlike these they are presented in ignorance of their full significance. It has been thought necessary to include them as they form an essential part of the results of our medical enquiry, and it has been our object to record this without any selection or mutilation.

3. Material

The report deals with the results of interrogation of 44 general duty officers and 37 medical officers in Bomber Command. As the method employed gave the examinee as much freedom as possible in the expression of his views, the topics discussed varied from one individual to another. In no case was it found on subsequent analysis that all the questions had been covered by one individual. The material therefore is not such as would result from a systematic questionnaire, but comprises a variety of positive opinions more or less relevant to the questions proposed. These opinions were given freely, as a rule emphatically, and appeared to reflect previous consideration of the topics discussed.

4. Method of presentation

The information was analysed under headings which had been formulated during collection, the points most frequently raised being given special prominence under each heading. When it seemed valuable the number of observers in agreement was stated and when there was divergence of opinion the number on each side. The relative numbers of general duty officers and medical officers were only stated when it seemed that the subject of discussion might concern one more than the other. As might be expected, some officers had given more thought to specific problems than others, and one more observant or thoughtful than his fellows would present a measured and critical statement, the importance of which was out of all proportion to its numerical significance. As the report is based on the pooled results of two investigators any unavoidable personal emphasis which might have been present in collecting the information has been reduced. The final synthesis of opinion presents a picture of existing conditions as described by others which has not been retouched or personally modified and a serious attempt has been made to maintain a true perspective. The report has been presented in three parts, the first dealing with the *Effects of Flying Stress*. This includes opinions on the purpose of looking out for these effects ; the value of an operational limit in preventing them ; the value of relief employment or rest in counteracting them ; and the measure of success at present achieved in getting men back fit for a second tour. The second section of the report deals with *Flying Stress, or the Load*, and includes opinions offered on the constituents of the load itself and the factors which may affect the man's ability to carry it. The third concerns the *Medical Officer's Function in Detecting and Preventing the Effects of Stress*. Although many of the subjects had a common application to all duties in the command there are obviously special problems inherent in the various duties performed. When they appeared to be specially relevant to one form of duty this has been indicated in the text.

PART ONE : THE EFFECTS OF FLYING STRESS

I. SIGNS INDICATING THE EFFECTS OF FLYING STRESS

1. Facts observed by others

(a) *Change in appearance, talk and behaviour.*—Forty-five officers, over half of them squadron and station commanders, said they could often tell by changes in his appearance, behaviour or conversation when a member of an operational air crew was beginning to feel the stress of his duties. Only three of the group, all experienced medical officers, thought it very easy to detect alterations in personality, but 30 said that if you know the man you can observe these subtle changes in the mess, at briefing, take-off and return, or elsewhere. They emphasised the difficulty of observing these changes in personality. One medical officer said that changes are difficult to assess unless the man is really well known, so that, because of the impossibility of mixing with N.C.Os. in their mess, he himself only felt confident when dealing with the officers with whom he lived and mixed freely. A station commander said that there are so many different types of individual, each of whom reacts differently, that one has to live with them and observe them closely to notice any change. The same number of observers had noticed increased restlessness, excitability or irritability as had observed decreased activity, quietness, loss of interest and a tendency to be solitary. The explanation of this was given by 25 people who said that the important thing to look for is a change in the individual's personality. As one medical officer put it : " You will notice, only if you know your men well, that a quiet man will become sociable and garrulous, and a normal man quiet, solitary and moody." Practically all stated or implied that the most significant sign was a change in behaviour whatever its direction, and they urged that the man had to be known personally to appreciate this change. This is not to say that the change is ephemeral and only to be appreciated by experts. It was noticed by ordinary men, living under ordinary Service conditions. Special signs of a positive kind frequently noted were increased excitability, restlessness, irritability, or truculence. These signs ranged from ' Making weak remarks around the mess and roaring with laughter at them ' to ' becoming irritable, sarcastic, truculent and out for trouble in the mess. ' The contrasting signs of unusual quietness, with a desire for solitude are equally evident. This behaviour is ' more obvious if the man is usually a good mixer. He ceases to be one of the party. He may remain in it without interest, or keep drifting away, starting a game of shove-halfpenny, but soon losing interest in even that. He breaks off a conversation and tends to be solitary, and later becomes unoccupied and lacks all initiative. ' ' They sit around in the mess without bothering to read—they just sit. ' They also go to sleep in their chairs.

Their facial expression may change in a variety of ways. They look tired and haggard, pale, worried, tense and nervy or miserable and depressed. One squadron commander said that after a few unpleasant experiences : " The man begins to look unhappy and worried and his face becomes rigid. You hear that he has become quiet and has withdrawn into himself." A medical officer reported a loss in weight of 14 pounds in 100 operational hours which was later rapidly regained. Slight changes in manner such as fidgeting and sometimes a tremor may be seen. Other observations have been a tendency to complain of trivial things ; inability to concentrate—' he chucks a book down instead of sticking to it, ' and increased smoking and drinking, which are referred to later. All these changes illustrate the alteration in total behaviour which has already been stressed.

The man's conversation fits in with this picture of loneliness and anxiety. ' He thinks about the casualties he has seen ; he talks about the people who have been shot down in the searchlights. In discussion in the mess he enlarges on the casualties, and his mind leans toward the dangers rather than concentrating on the job in hand. He is fidgety and not in repose and looks here, there and everywhere.' One station commander called this a state of alarm.

Although these signs have been reported by so many, a man who has long passed his peak of operational efficiency 'may appear quite normal, so that sometimes you find that when you are sure a man is feeling strained you are wrong and that those who break down may not show any symptoms.'

(*b*) *Loss of keenness for flying duties.*—One observer remarked: "The first evidence of the effects of flying stress is usually to be found in diminished enthusiasm. A keen man will react to the announcement of 'a heavily defended target for to-night' with immediate professional interest, but if he is suffering from the effects of stress he will show his lack of keenness by immediate preoccupation with the defences." This loss of keenness has been described by 20 observers, 15 being station or squadron commanders. A lack of enthusiasm, apparent in the man's manner or conversation may be seen at briefing, when unnecessary questions may be asked about the sortie, or trivial reasons may be given for not flying. In the mess he may be half-hearted and mention the possibility of icing-up. Some men over-compensate and appear wildly enthusiastic, emphasising their keenness too forcibly. These signs are most apparent to the crews and squadron officers but they can also be seen by the medical officer. They may be the very first signs of deterioration, and, as they can be directly observed by the executive officers, are especially valuable.

(*c*) *Loss of efficiency.*—Flying stress may cause loss of efficiency in operational flying, which can be recognised by squadron and flight commanders. A number of ways in which it might appear were described. The actual standard of flying may decline; there may be foolish errors of judgment; gross carelessness, leading to bad landings or crashes. In operations, carelessness or recklessness may lead to catastrophes, the real cause of which would be unknown unless the crews are fortunate enough to escape, when they may return and report lack of proper evasive action, or the acceptance of foolish risks. When one particular aircraft is badly damaged in successive trips 'this usually means that the pilot's judgment is going. He forces himself to go in regardless of risks because he is afraid that his nerve is getting shaky.' 'The navigator may become inefficient and make silly mistakes, he gives wrong fixes, or sets the wrong course,' or he may 'go to pieces over the target.'

More often, an aircraft returns before reaching the target, a mechanical defect being blamed. The defects may be trivial or imaginary, and they include minor engine troubles, such as a fall in revs or oil pressure, turret trouble, or difficulty with the intercomm. These unnecessary failures are usually due to the captain of the aircraft. Once they occur they tend to be repeated, a different reason being found each time. They sometimes cause operational squadron commanders great anxiety and one said that when a crew returns without reaching the target more than once, he immediately investigates the cause. Another described how he used to go into the aircraft himself when an unconfirmed defect was reported immediately before take off, to investigate. He would explain that all was well and if there was still reluctance on the part of the captain, he would invite another pilot to fly the aircraft. Another squadron commander regularly visited each aircraft with the engineer officer just before take off, 'just to pat them on the back and nurse them into the air, but chiefly to prevent returns for mechanical defects.'

Over-the-target inefficiency may be apparent in high bombing and in failure to press home the attack, with inaccuracy or actual jettisoning of the bombs on the fringe of the target. At other times the inefficient crew may fail to find the target. Such evidence of inefficiency is commonly associated with some of the signs of individual deterioration which have already been described. A squadron commander said: "You can usually tell when a man has had enough, you can tell by the results of his trips. He either takes undue risks or becomes over-cautious. If you study a man carefully you will find that he behaves rather differently during operations. In the first five trips it is well to sum up what he is like. After that if he alters at all you must look out for trouble. Generally the extreme he will go to depends on his wanting to do the opposite to what he feels, so that if he is feeling afraid he compensates by new risks." One medical officer emphasised that information is only available on those airmen who return from operations. He argued that if, as has already been stated, carelessness, recklessness and loss of judgment result from excessive stress, there must surely be an abnormally high casualty rate in the air crews who, through one member, have become inefficient.

(*d*) *Alcoholic excess.*—Of 25 officers who mentioned this subject, all except one had at some time observed increased drinking as a result of stress in flying crews. Usually the symptom has a gradual onset, is steadily progressive, and 'quite different from the occasional outburst used to relieve tension after an unpleasant experience.' It is accompanied by the other signs which have been described.

2. Facts reported by the man

Physical symptoms.—A medical officer said: "There are two sorts of men. The first report sick with some trivial complaint which has no real physical basis. After a talk if you ask them why they have come to sick quarters they will say that they are afraid or that they panic in the air. The other sort never report sick. They show their signs and symptoms in the mess, but they keep on flying and in the end write themselves off, because they become inefficient through loss of judgment." The second group has already been dealt with. There is in fact a third group, who say quite honestly that they cannot carry on—they will be discussed later.

Those who come complaining of physical symptoms can readily be divided into:—

(*a*) *Those who are exaggerating an existing slight disability.*—They use 'some existing physical reason such as a visual defect or a varicocele' to take them off flying, or they may repeatedly report sick with mild 'sinus trouble', or airsickness which is not in fact incapacitating. They are the smallest group and the least likely to return to operational flying. They may use their disability after they have been briefed for a particularly hazardous sortie, the anticipation of which is too much for them. One man used a small boil in this way, but when eventually it had recovered he said that he was too afraid to fly again. Complaints of sinus trouble, including nasal catarrh and ear trouble are also frequent. Here no accompanying signs may be found and one medical officer said that anomalies in the onset of pain in relation to altitude may give a clue to its psychological cause. These people do not suggest that they cannot fly until the motive behind their complaints has been exposed. They then have to make the decision whether or not they will fly again. The result of the decision is usually unsatisfactory.

(*b*) *Those who have physical symptoms resulting entirely from mental strain.*—This group (the largest) has been described by 27 observers. As one squadron commander put it: "They come complaining of trivial physical ailments which have no real foundation. This is especially evident if they get wind early of a particularly bad raid—even very good men do this sometimes."

The most common symptoms are abdominal discomfort, nausea, mild dyspepsia, and even vomiting. These symptoms are not caused by flying as such, but originate in the visceral response to anticipation of danger. ' Occasionally mild dyspepsia and a feeling of discomfort and impending diarrhoea may occur before operations, especially on approaching the aircraft. It disappears once they are on board.' Headache and visual complaints, such as eye strain, pain over the eyes, or blurring of vision are almost as common. Some men report sick repeatedly in this way throughout their tour. A medical officer said, " I keep them going by explanation and encouragement—even if they have purely physical complaints I talk to them about fear, quite frankly, and explain that it is not peculiar to them alone. This helps them greatly, and even if their symptoms don't go, they carry on."

It is unusual for these men to say at first that they cannot carry on with operations. ' They all exaggerate the point that they don't want to come off flying. But later, if they are kept on they may say that they do not think it fair to the rest of the crew that they should carry on, because they are afraid they may let them down.' Ultimately, when they are faced with the question of their inability to carry on, or their fear of doing so, they describe the fear and stress which have produced their symptoms. Whatever their reaction to this situation, whether an admission of fear, an inability to carry on or a refusal to do so, the outlook, compared with those who in the first place came saying frankly that they were afraid and could not go on, is bad. It is important to exclude physical causes for the disorder, as some of those with symptoms such as headaches, sickness, sleep troubles and loss of weight may be suffering from bodily illness. An experienced medical officer said, " It is difficult to distinguish between the man who doesn't like it and the one who is genuinely ill, but it is most important to do so, and you must weigh up the whole man."

Sleeplessness may be a prominent feature in this group. It was reported by 11 observers and may be associated with nightmares related to flying experiences. ' They come complaining of sleeplessness and dreaming of flak all night long.' Only one medical officer reported fatigue as a symptom. Tiredness is sometimes used to mean loss of zest for flying, but here the mechanism is apparent and the symptoms not primarily based on physical or mental fatigue, which are discussed under The Load.

(c) *Those unable to carry on.*—Fifteen officers observed that a man may go to his squadron or flight commander and say that he cannot carry on with operational flying. He may imply that he can never return to operations or say that he simply needs a temporary rest. The outlook in both these groups, with careful handling, is better than in those already described who have spurious or real physical symptoms. Sometimes they frankly admit fear or say that their nerve has gone. ' The man who comes up complaining of inability to carry on is the honest type, and there is more chance of getting him back to flying than the others.' There seems general agreement with this statement, the experience being that ' If a man is honest with himself to say that he has had enough, he will come to the squadron commander straight away and something can be done about it.' The management of these men obviously depends mainly upon the stress to which they have been submitted. They will be dealt with more fully under Operational Limit.

3. Facts noticed, but not reported, by the man himself

These observations are based on the introspective accounts of their reactions to stress given by squadron commanders, in order to illustrate their discussion of points in squadron management. These officers had all completed one or more tours without having reported any symptoms, or having been taken off operations before the limit of the tour had been reached. The most common observation of these officers was of their personal experience of increasing fear in the later stages of an operational tour. The intensity of fear, usually anticipatory in type, may be associated with increasing physical symptoms. One said: "I judge these men entirely on my own reactions because I know what it is like both before a trip and when you start a second tour. Everyone is frightened and if they could stop reasonably they would, unless they were damn fools." A squadron commander, talking of the factors which caused failure for non-medical reasons, said: "If they are as afraid as I am they know what wind-up is. They are scared stiff and I don't blame them either." They may lose confidence in themselves in the air and experience panic over the target.

Although the usual story is that of fear, the complaint may be of fatigue, as with one officer who, after 40 hours in his second tour, found himself tired, listless and slow in taking evasive action. He found that after a little while in the air his instrument panels invariably became double. He went on leave and his symptoms disappeared. Another squadron commander said that he became tired and his fear became obvious and increasingly difficult to control. In the end he was shaky and whenever a gun opened up he would jump. He completed his tour successfully. A squadron commander of great distinction said he lost a stone in weight during a period of intensive operations, but he soon regained it in a rest period afterwards. Another said that he became sleepless and dreamed about his flying experiences. It was noticeable that in describing their own reactions to stress these officers dwelt upon the primary symptoms—fear and fatigue, rather than those of secondary development, thus showing evidence of their superior intelligence and insight.

II. RÔLE OF THE MEDICAL OFFICER IN DETECTING THE EFFECTS OF STRESS

Out of 26 general duty officers who discussed the function of the medical officer in this respect, only 2 doubted his value. One took the extreme view that the medical officer should not be concerned with this problem. He thought, nevertheless, that the medical officer was valuable in maintaining morale in the squadron. The other believed that a good squadron commander had greater opportunities for observing the crews than had the medical officer, and that unless tactful, a medical officer could do harm by over-scrupulous enquiry about the welfare of air crews. All the others were emphatic as to the value of a good squadron medical officer and welcomed his advice in deciding when a man had had enough (see page 38). A squadron commander said: "I get a tremendous lot of information from him about the ability of people to carry on. We believe in not keeping a man on until he breaks, but posting him so that he won't break, and we will get him back later. For this I rely to a very great extent on the judgment of the medical officer." The 24 general duty officers who referred to the co-operation between the medical officer and themselves said that the medical officer came to them with advice and information about air crews, and they in turn went to the medical officer. They liked him to take the initiative and to come to them spontaneously. The squadron medical officer should be the intermediary between the squadron and the squadron commander in this respect, but although the liaison should be close, it should also be unobstrusive, so that however great the understanding, on the station their relationship should be that of commanding officer and subordinate. Having noticed the earliest signs of deterioration, even when a man has come to him in confidence, he should then refer the question of future management to the squadron or flight commander who, usually, will welcome his further advice. One commanding officer said: "The doctor sees a man from one angle and I see him from another."

To enable the medical officer to observe the earliest signs of deterioration and especially to be able to appreciate the changes in personality which may occur, he must always be in intimate contact with the crews. He should mix with them in the mess, drink with them and go on parties with them. In duty hours he should spend time in the crew rooms and hangars, and during operations should be present at briefing, take-off, return and interrogation. In order to establish common interest, he should fly occasionally and be concerned for all aspects of squadron life—in fact he should 'think squadron and live squadron every minute of the day'. His observation of the crews must never be apparent, but should take the form of friendly interest. A number of highly successful medical officers supplement this with a private card index system, recording the personal characteristics, flying experience, operational stress, and successes of each man.

The observation and assessment of officers are made easy by the readiness with which contact can be made with them in the mess. It is quite different with the N.C.Os., into whose mess an officer hesitates to intrude, and so suggestions for a common mess or club for flying personnel have been made partly to remedy this (*Living Conditions*, page 59). The medical officer can increase his contacts with the crews and his observation of them by making use of his relationship to them as their doctor. When the crews respect his opinion they will come to him for advice, and having done so they may readily be engaged in a discussion about themselves or their work. 'If they have confidence in the medical officer they will come before they have actually thrown their hand in.' When they ask to see him an immediate and informal interview should be arranged. One squadron medical officer arranged for one heavy bomber crew each day to come to the station sick quarters for ultra-violet light. During the time they sat round the lamp he got to know them personally. Another arranged informal discussions on oxygen, equipment and quasi-medical affairs, ostensibly for education, actually for observation and personal contact. In order to maintain this relationship with the crews the medical officer needs special personal qualities which are dealt with in (*Role of the medical officer in relation to the load*, pp. 61–62).

III OPERATIONAL LIMIT

1. Reasons for and against an operational limit

Definite opinions were expressed on this subject by 43 officers, all except three of whom were in favour of a limit of some sort. The more important reasons in favour of it were as follows. Although any widely-applied limit has disadvantages, an arbitrary limit is as practicable a method of maintaining efficiency as any. There must be a yard-stick for the squadron commander's use and with it he is given a standard reference point from which he can measure the achievement of individual members of his squadron. Not only does it remove great responsibility from his shoulders, but it helps in handling those who are sub-standard. It also provides a measure of safety, for some commanders find it impossible to assess a man's capacity, and some men do not show that they have passed their peak until they have deteriorated greatly. It is particularly useful in dealing with N.C.Os. who form the bulk of the squadron but who are not intimately known to the squadron and flight commanders, and may well show the effects of stress without his knowledge.

The limit also helps the crews themselves. They know roughly the degree of effort required of them, and they do not have the alternative of continuing operations until they are killed, missing or showing symptoms. They can look forward to the end of the tour and they have a goal at which to aim. If the limit is within the reach of the average member of a crew he will be removed before deterioration begins and so can remain efficient for a second tour (*Second Tour*, page 63). Lastly, even were it encouraged, many men would not report that they had passed their zenith or had reached the limit of their endurance, through a misplaced sense of guilt. Rather, a competitive spirit would be fostered which, by overtaxing the average crew member, would ultimately have disastrous results. Having a constantly applied limit is much fairer on everybody, for they are all asked to make the same effort. The objections to a limit were based on a recognition of the variations in the individual capacity to carry the load.

2. Comments on the present arrangement of tour

(*a*) *The measure.*—Seventeen officers approved of the 200-hour limit for heavy bombers, but 11 thought that it was unsatisfactory. The main objections were that the effort could not equitably be measured in hours. The new four-engined bomber must make about 40 trips as opposed to 30 in twin-engined craft. Stations further removed from enemy territory on account of the greater distance include fewer sorties in their 200 hours. Therefore the load may be more accurate if measured by the number of sorties than by the number of hours. Three thought that 200 hours was beyond the reach of the average man, and that if the limit were lower, more men would be available for an efficient second tour.

(*b*) *Flexibility.*—Of 17 officers who discussed this point, only two were in favour of an inflexible limit. The remainder thought the present system too rigid. The reasons for this were expressed as follows: 'The 200-hour limit is too rigid, for it makes the nervous man more nervous. If it were made elastic there would be less anxiety at the end of the tour. At present the men feel they must conserve themselves in the last few trips, which they may stretch out to add as many hours as possible to the total.' Some tend to take undue risks in the last few trips, so that one wing commander said: "If ever I hear a man say 'this is my last trip', either I don't send him on the trip or I tell him he has another dozen to do, then send him twice more and unexpectedly take him off". Several thought that although the present limit should be used, it should in fact be a maximum limit, above which no one should go, but below which, men could be rested without any stigma. One commander put it thus: "The 200-hour limit is reasonable, but the discretion to take a man off should be left to the station and squadron commander with the medical officer." Good types of men who come off before the limit is reached should not be considered to be lacking in moral fibre, for some men have to finish before others. The universal application of a fixed limit is unfair. An equable figure cannot be adopted because 'the strain varies with the type of work, rate of loss, degree of success, type of man'. Another officer added the type of aircraft to this list of variable factors. The general opinion was that these factors, especially the variation in temperament and operational conditions, were so potent that they made a fixed limit undesirable.

(*c*) *Knowing the limit.*—All except six approved of the limit being known for the reasons already given. These six mentioned the excessive caution or recklessness at the end of the tour which has been described above. Two thought that the suggestion of a limit to one's duty was bad for the morale of the Service.

(*d*) *Constructive suggestions.*—The commonest view expressed was that the limit should remain at 200 hours, but that discretion should be left to the station authorities to take a man off sooner, if they thought it advisable, without any formal action, or further opinion. The mechanism suggested was that the flight commander or squadron medical officer should help the squadron commander by reporting signs of stress. The squadron commander would then weigh up the man's performance and the operational hours completed, taking into account his temperament and his present condition. If considered fit, he would then recommend that he should be sent to relief employment.

It was suggested by some that the station and squadron commanders with the squadron medical officer should hold a relief employment board either as the necessity arose or as a periodic review of those in the second half of the tour. If the men remained well they would be taken off at a fixed upper limit. There would therefore be a maximum but no fixed minimum to the number of hours constituting a tour. There were notable exceptions to this point of view. A squadron commander had had so much success in bolstering up morale and keeping sub-average men going to the end of the tour that he would never hear of anyone being taken off before the 200 hour mark without disciplinary action. In the light of his own operational experience he considered that the strain of continued fear was such that everyone would prefer to come off earlier if he had a valid reason for doing so. It was also suggested that there should be a fixed limit within the compass of the average crew, but that the limit should vary, its level depending on the type of duty and aircraft used. A flexible guiding limit was also suggested. This would be used to indicate what may be expected of the average crews in set circumstances. It would be modified by the squadron commander as already outlined. Lastly, there was a suggestion to set an arbitrary minimum as well as a maximum, a report being submitted if a man were taken off below the minimum. There was fairly general agreement that no one should be allowed to elect to operate beyond the limit, because this would defeat its object by causing competition and invidious distinction, and encouraging the man with a strong sense of duty to strain himself beyond his capacity. Two commanders thought that an extra 50 hours should be allowed those who were still at their peak efficiency.

One distinguished squadron commander summed up the problem of the limit as follows: " The operational performance of a good crew goes steadily uphill to a peak. It then levels off and later comes down again. The deterioration is due to operational and not physical tiredness. The man should be caught at his peak before he begins to crack up. If he is rested at the peak of his form he will come back from the O.T.U. ready for a second tour, but if you send him back when he is getting to the quiet stage, he will not return, for his reaction will be severe." It is therefore impossible to keep a hard and fast limit. Men should be taken off when they have had enough but there should be an arbitrary minimum to guide the squadron commander, and a report should be rendered if a man comes off too soon. There should also be a known arbitrary maximum so that the good men will know when they are going to get their rest, but some, especially in day bombing, will need to come off long before this, since apart from individual variation in capacity to withstand the strain, the strain of the trips varies. If there is no maximum, the very keen crew will go on indefinitely and never be any good again. The factors determining the limit for day bombers are different. (*Conditions peculiar to Day Bomber Squadrons*, pages 62–64).

IV. RELIEF EMPLOYMENT

1. Many of those interviewed, having discussed the value of recognising when a man has had enough, with the object of insuring his fitness for a second tour, proceeded to give their opinions upon the most suitable form of employment for him in the interval. These opinions were invariably based upon the necessity in Bomber Command for a steady supply of men with operational experience to act as instructors in the O.T.Us., the O.T.U. not being just a rest, but alternative duty. This was accepted as the controlling factor in determining the nature of relief employment for the majority. Of 35 officers, all except one said that most men dislike going to the O.T.U. and would welcome any alternative.

2. Comments on present arrangements for relief employment

(*a*) *Lack of rest experienced at an O.T.U.*—A wing commander said: "The O.T.U. is a relief from nervous tension, but it is no rest physically. They hate the O.T.U. because it is much harder work. They start early in the morning and go on late at night, but it does keep them in with flying." Added to the fatigue of long flying hours, there was the constant strain of teaching, the anxiety caused by inexperienced pupils and awareness of the extra risk involved in flying hard-worked and badly handled aircraft. One squadron commander, who also suffered from temperamental unsuitability for instructional duties, expressed himself thus: "I went to an O.T.U. and was dead tired in no time, and frightened stiff too."

(*b*) *Duration of relief employment.*—A rest is needed from operations, and for a time the man benefits from the change. After a while he becomes conscious of the security of his new employment and develops a liking for it. His contact with operational flying becomes remote and he is loth to return. As time goes on the effort needed to return becomes greater and he has become at heart a permanent instructor.

(*c*) *Temperamental suitability.*—The opinion was expressed that from the beginning some men like instructing and that these make the good instructors. Many others after disliking the work at first, make an adjustment and settle down to it. There is also a considerable number who continue to dislike instructing and are inefficient at it. For these the period of employment at an O.T.U. is the greatest strain. A squadron commander in his second tour, in discussing his own experience, stated that he knew that he was not mentally suited for instructing. When he went to an O.T.U. he realised that owing to his inability to teach them, his pupils would be inefficient and would come to grief, and this was what in fact happened.

(*d*) *Atmosphere.*—Some men do not benefit by a period at an O.T.U. because the contrast is not great enough. The aircraft are the same, the flying hours are high, there may still be anxiety, especially when dual control is not used, and the preparation for operations is apparent everywhere. On the other hand there is not the same sense of achievement as at an operational station, and there is less freedom.

(*e*) *Screening.*—Men are at present anxious lest they will be brought out of relief employment to go on special raids or maximal efforts shortly after they have completed their tour. The possibility of this has a demoralising effect and was strongly deprecated. The effect of this was more marked on the squadron than on the man himself. Crews still on operations knew that some of their colleagues had been sent on a raid shortly after going on to relief employment. They felt that they would never have a guaranteed rest period. The effect of casualties in these men was particularly disastrous.

3. Constructive suggestions

(*a*) *Alternative employment.*—Twenty-four officers mentioned this possibility. Some thought that in spite of the need for instructors in O.T.Us. more opportunities should be offered for alternative employment. This should not be optional 'as no one would ever go to the O.T.Us.' Rather, the small proportion of men for whom an alternative form of employment seems desirable should be selected by the station and squadron commanders, particular attention being given to temperamental suitability for instructional duties. A number of suggestions were made as to the form that such alternative employment should take, including an exchange into other commands, or ground employment with opportunities for occasional flying. One experienced officer considered that if it were not for the needs of the O.T.Us. a period of six to eight weeks away from flying and the Service would be the best preparation for returning to a second tour. Eleven general duty officers suggested *relief employment in another command.* Eight advised exchange between Bomber and Flying Training Command on the grounds that instructing at F.T.S. would offer greater change and relaxation. They contended that the pupils at the F.T.S. would also gain by contact with men who had had experience of operations. All but one agreed that relief employment should always include flying duties. It was also suggested that facilities should be available for temporary transfer of some to Coastal or Ferry Command. A station commander said: "At present the commands are quite independent, and people in Bomber Command have the hardest time. They are either operating or instructing. There should be a constant flow to all commands so that people would each have one operational tour, one period of instructing, and then go on to such jobs as ferrying, Catalinas, and so on, instead of their second tour. In the end their appetite would return." To allow sufficient time to arrange a transfer, it was suggested that a month or so before the end of a tour the station commander should be told what relief employment a man would prefer.

(*b*) *Duration of relief employment.*—The ideal time needed to recuperate and return to operational flying was thought to be about 3 to 6 months. This short period of relief employment was thought ample because 'the longer you are off the harder it is to return.' It was recognised that in this time the instructor had just been trained and was only beginning to become efficient, but the length of time should be a compromise between that needed for return to operations at maximum efficiency, and the minimum required from the new instructor at the O.T.U. A stay of as long as 18 months at an O.T.U. was too long and made the return very difficult. Two observers thought it better to fix the period of relief employment at the O.T.U. in flying hours, and one said it should not exceed 200.

V. THE VALUE OF MEN RETURNING FOR A SECOND TOUR

Eleven officers who discussed this subject were unanimous in the opinion that the men who came back fit for a second tour were of great value to their squadrons. It was therefore most important that they should be well looked after during the first tour and protected from the effects of excessive stress. One squadron commander summed up his experience thus: "Those men who return for their second tour are immensely valuable. They are experienced, well trained, and teach the others. They usually come back as officers, making valuable flight commanders or seconds in command. It is well worth nursing them on the first tour because if they are looked after they come back just as, or even more, efficient." He went on to say that the duration of the first tour was in his experience a factor of importance in determining the value of a second-tour man. He preferred a man who had done 20 sorties to the man who had done 45. He believed it possible by careful handling to get three short tours from the same man. The need for good leaders was such that the conservation of these experienced men was most important. The same opinion was expressed by a station commander who said: "You should always aim at getting your men back on a second tour because these experienced men make very good leaders"; and by a station medical officer of great experience who said: "If you bring them back for a second tour while still fit they will be very good and even better than during the first. They will make the leaders."

From these opinions it may be concluded that the early detection of the signs of overloading, before any irreparable harm has been done, is of great practical value for operational efficiency. It follows that a proper understanding of the factors affecting the load are of equal importance.

PART TWO: FLYING STRESS—THE LOAD

I. FACTORS CONTRIBUTING TO THE LOAD

The present investigation reveals, as might have been expected, that picked men under certain conditions may carry a load of mental and physical strain far greater than could have been predicted, and this without complaint or surprise to themselves. The load is relative. There are natural sources of strength and endurance to support it, together with the advantages of training, discipline, leadership and morale, and the confidence born of first-rate equipment. Analysis of flying stress, therefore, must take into account not only the factors which contribute to the load, but those which increase or impair a man's ability to carry it. This was at once apparent in the answers obtained to the question: "What are the things which get people down?" for they referred as often to lack of the supporting as excess of the loading factors. In presenting our material we have distinguished, as far as possible, between factors contributing to the load and factors affecting the man's ability to carry the load. We shall conclude by presenting opinions obtained upon the function of the medical officer in lessening the load and helping the man to carry it.

1. Operational conditions

(a) Nature of operations

(i) *The weather.*—The effect of bad weather on the morale of flying personnel, discussed by 30 officers, depends on whether it influences the trip out, conditions over the target, the return, or whether it causes postponement or cancellation of the sortie. On the trip out weather plays little part in adding to the load so long as there is not heavy icing. Over the target bad visibility is demoralising because the crews get disheartened when they do not see the results of their raid, and they are apt to feel that they have wasted their time if they do not know how accurate their bombing has been. In contrast, uplift due to good visibility such as the 1942 raids on Paris and Cologne was enormous. (*Success*, pages 55–66).

On return bad weather adds to the load, because crews worry about the return to base, finding it, and landing in poor visibility or bad weather, more than actually doing the job of bombing. Anxiety about the risks of the return trip has been lessened by the use of improved navigational aids. (*Hazardous Return*, pages 44–45). In causing cancellation, postponement or inactivity, weather may be an important adverse factor.

(ii) *Length of trip.*—The majority said that the length of trip at night did not affect the load, one even thought that crews preferred long trips which make their operational tour go quickly. When over the sea a long trip causes little anxiety, unless there is a specific fear of sea crossings, but if it involves many hours over Germany the anxiety is increased. A long trip on their own, particularly if the automatic pilot is not working, may cause fatigue, but in the ordinary course of events it has no bad effect. Even so, it is good for the sake of morale to throw in a few short easy trips from time to time. In day bombers, however, the strain is greatly increased on a long trip.

(iii) *Enemy defences.*—The extent to which the hazards of the enemy defences increase the load of the crews was described by 32 observers. It depends upon three distinct factors :—

The nature and intensity of the defences.—There was agreement that the intensity of the defences adds to the anxiety of a sortie. As one squadron commander put it: "You would go crackers if you were kept going to Essen or Kiel, whereas Bremen is easy". The increase in the enemy's defences in the last year has greatly increased the stress of operations and many observers referred indirectly to this in discussing stress in relation to the operational limit. There was great difference of opinion as to the effects of different types of defence. On the whole, the most demoralising are searchlights because they are so obviously looking for one, and because the effects of being coned are so serious. They usually cannot see night fighters (so that they do not add greatly to the anxiety) and the crews are aware that they are only really effective after they have been coned, or on a moonlight night. If the crew runs into heavy flak it upsets them, but light flak, which can be seen and often avoided, has no bad effect. Flak reduces their operational efficiency because they spend their time taking evasive action, but this preoccupation with action reduces their anxiety.

The psychological effects of having got away with it in spite of severe opposition.—It seems that the demoralising effects of the enemy defences are mainly anticipatory. If little opposition is encountered the crews consider they have had an easy trip, and have caught the enemy napping. Consequently their confidence is increased. If they return having encountered intense and accurate opposition they have not only a sense of relief but also a feeling of self-confidence, for they have shown that even the worst the enemy can do does not stop them returning. This paradoxical response to danger may be very marked. When another crew, less fortunate, is missing they treat it impersonally. Having escaped themselves they are buoyed up until the same target is briefed again. They then anticipate the dangers which are in front of them, and there is recrudescence of fear. The way in which the crew responds to a target defended by heavy flak is a good index of how they will last the tour.

The specific and often irrational fears of the individual.—Four officers raised the subject of specific fears. One man may have a specific fear of flak, another more calculating, may consider that to be hit by flak is just bad luck, and realise that night fighters are really more dangerous. One may be afraid of searchlights to a degree which in the light of experience is irrational, while another may feel that although searchlights are very unpleasant they are in reality just a nuisance. It was evident that in assessing operational stress no yard-stick could be adopted, but individual susceptibilities had to be considered.

(iv) *Hazardous return.*—Thirteen observers discussed the uncertainty and dangers of returning from the sortie as a factor which might sometimes be important in increasing the load. Four thought that being lost was the most potent cause of anxiety and might prove a great strain, especially for the sub-average man (*Weather*, page 43). Two of these added that with the improved navigational aids now in use this was an infrequent occurrence. A long return trip over enemy territory naturally added to the load, as did engine failure or damage to the aircraft by flak, but if they got back safely with a damaged aircraft or with one engine cut, their confidence was greatly enhanced and they felt that for the next trip with an efficient aircraft they had plenty of reserve in hand.

(b) Anticipation

It was evident from the opinion of 33 officers who discussed the emotional results of the cancellation of a sortie that the anticipation of a raid is as great a load as the raid itself, unless this happens to be unusually hazardous. 'As soon as the day breaks there is a strain, because they are looking forward to the operation, and the sooner they know it is on or off the better they like it, so that uncertain weather has a particularly bad effect on them.' Several squadron commanders consequently planned an early briefing to allay the crews' doubts, but one very experienced officer said he preferred them to have as full a day as possible, and so made briefing very late to reduce anticipation of the raid itself. A commander of a day bomber squadron said: "Prolonged standing by, which has reached 16 hours on end, does them much more harm than the operation. The strain of standing by is great, but when you are under way everything is all right". Another commander said: "When they are briefed in bad weather there is a deterioration in morale, because there is the uncertainty. The whole nerve strain of an operation lies in getting ready for it, so that when a raid is cancelled it should really count as a sortie. The operation itself doesn't get them down, it is thinking what might happen that does."

(i) *Briefing.*—Sixteen officers agreed that the form of briefing may affect morale greatly. They thought that briefing should be short and to the point and should not be touched up with encouragement 'to go in and win' or the justification of possible casualties. Rather there should be factual emphasis on the importance of the target, the purpose of its destruction, and the most economical way of achieving it. 'It is best not to question that they will all come back, but give it to them straight, telling them the dangers, giving the reasons, describing the plans and showing why they should not go wrong.' In this way professional interest in all aspects of the raid is fostered, and morbid anticipation of catastrophes limited.

(ii) *Cancellation.*—The disastrous effects upon morale of repeated cancellation of sorties, especially when late in the day, was emphasised by 33 observers. An experienced squadron commander said that 'last minute scrubbing' was the most demoralising factor with which he had to contend in managing an operational squadron. He would much rather send his squadron on a raid even with ten-tenths cloud over the target, than subject them to the disappointment, frustration and demoralisation of last minute cancellation due to weather conditions on the Continent.

Late cancellations.—Most of these 33 observers said that the lateness of the cancellation was the worst factor. Cancellation of sorties due to bad or deteriorating weather was unavoidable, but the earlier in the day the cancellation was known to the crews the milder was the reaction to it. A station commander said: "A last-minute cancellation, waiting for bad weather to change, or waiting for a delayed operation has a most demoralising effect," and a squadron commander: "I have been revving up my engines when I've been told to turn back. It just about makes me burst a blood vessel." A station medical officer observed: "Scrubbing may occur so late that they cannot make any plans for an evening off. This sometimes happens for a whole week, and gets them right down."

Repeated cancellations.—Even if sorties are not cancelled at the last minute, in continued bad weather crews may be briefed day after day without going on a raid. As examples, one station commander mentioned this as having occurred for 18 nights in succession, and a squadron commander said that his squadron had been standing by every day except five for a whole month without operating at all. As an instance of the bad effect of repeated cancellation upon morale, a station medical officer remarked : " One freshman was scrubbed 17 times before he got his first trip. He only lasted three trips after this, and then said he had had it".

The effect of cancellations was described as a lowering of morale throughout the squadron. It becomes apparent after five or six postponements and affects freshmen and captains specially. The bad effects are shown in the men's behaviour, for they become dissatisfied and irritable. The main causes for this are :—

> A repeated cycle of preparation, anxiety, excitement and strain, followed by prolonged suspense and then ultimate frustration. This seems to have been particularly potent in the case of the freshman already quoted.
>
> Prolonged inactivity in bad weather. When a sortie is expected alternative programmes cannot be arranged and the crews hang around most of the days unoccupied (*Inactivity*, paragraph (c) below).
>
> After the emotional tension of the day the crews, ultimately released, find it is too late to arrange any form of recreation, and so continue to hang about the station, mess or bars.

(iii) *Constructive suggestions.*—There was unanimity in urging that cancellation should be announced by Group as early in the day as possible. A squadron commander said that maintenance of morale was so important that it would be preferable only to brief a raid if the weather was very likely to be suitable, even if this meant the sacrifice of some of the operational effort. A station commander said that he had maintained morale in the winter by taking the responsibility of not announcing an operation if the weather conditions were likely to prevent it. He thought the risk he had taken was justified, but fortunately had not been wrong in his judgments. He suggested that whenever possible the crews should be told definitely, early in the day, that there would or would not be operations that night. These observers said that excessive difficulties may be insuperable and scrubbing inevitable, but they stressed the serious effects of delay, inactivity and cancellation, and thought that air crew morale should be taken into consideration in shaping the operational programme.

(c) Operational inactivity

Thirty-one observers said that when inactivity was prolonged this caused a deterioration in morale. 'Last summer our losses were terrific, but there was not nearly the fall in morale that there was during the winter's inactivity.' 'They are far more contented when at the job regularly. After a raid there is something to talk about which is interesting and stimulating, but the period of waiting and anticipation is a strain.' A few days of inactivity is very useful for training, lectures and recreation, but after about a week 'it begins to get them down'. The effect is particularly seen before the first sortie after a quiet period (*Signs*, pp. 33–37). Squadron commanders agreed that with a little initiative and ingenuity the time can be filled in. 'I point out that training is the best insurance policy they can take out, and when ops. are impossible I keep them at it.' Lectures, films, discussions on technique and equipment, air training, organised games and recreation can be arranged with a little foresight, during bad weather periods.

(d) Critical points

In heavy bombers there are three critical periods in the tour at which men are likely to show the effects of stress, as well as the critical period after exceptional strain has been experienced.

(i) *In the first few trips.*—Twelve observers reported spontaneously that between the 3rd and 6th trip there is a great likelihood of *waverers* reporting that they cannot go on with their duty. There was striking agreement in the story. 'In the first few trips he sees what he is up against, in the next he makes an effort, but by the 6th he has thrown his hand in.' He usually manages the first three. He is invariably an unsuitable individual and the outlook is usually hopeless.

(ii) *Around the 12th to 14th trip.*—Nine observers reported that during the first 12 trips a man has come to a full realisation of the hazards of his duty. The end of the tour is far off and he feels he cannot go on. 'He begins to count how long he has to go.' Again there was close agreement upon the time of onset. 'They begin to realise the dangers and reach the critical point after about 14 trips. It is much easier to get the first half of a tour out of a man than the second.' This critical point may be heightened by the added responsibility of being first pilot. These men, with explanation and encouragement, control their fear, and nearly all go back to complete their tour.

(iii) *At the 24th or 25th trip.*—Near the end of the tour some men who have had a hard tour of duty, or who have not the staying power, report sick or see the squadron commander. They are showing the effects of stress, and should be rested. Most of them will do well.

(iv) *After exceptional stress.*—There is a critical period immediately after a bad crash, a forced landing in the sea, or a succession of unpleasant experiences. This is fortuitous and may of course occur anywhere in the tour. One medical officer said: "There is nothing you can do about it—it happens before you know." Two others advised immediate prophylactic treatment—securing prolonged sleep, advice and encouragement, a further trip or two and then leave: the results, they report, are good.

2. Some physical factors

(a) Physical fatigue

Physical fatigue is considered here as one of the loading factors adding to the stress of operations. It is to be distinguished from the feeling of tiredness, or from the evidences of deterioration which have already been considered (*see* Signs, pp. 33–47).

Few of the officers interrogated thought that in the ordinary course of events physical fatigue added greatly to the stress of an operational tour. Twenty-two of the 32 who mentioned fatigue said that it was usually insignificant. Six said that there may be physical fatigue during a period of intensive operations. In these circumstances the fatigue may be such that actual deterioration in efficiency may occur. For instance, a station commander stated that one time after his squadron had done seven raids in 12 nights they were obviously tired, and at the end were not finding their target. One medical officer would chart each man's operational effort from his crew's accounts and the fortnightly squadron returns, to ensure that a crew was not being overworked. The relation of the intensity of the operational effort to fatigue and the value of spacing the number and types of target are fully dealt with in *Spacing of Effort*, pp. 54–55.

Physical fatigue is sometimes encountered apart from these periods of overwork. A medical officer said, " Fatigue is an important adverse factor and is largely physical. This is not due to the length of the trips but to the uneven rhythm of sleep and feeding during the operational period. Even a tough man at the end of his tour will spend most of his leave in sleeping " (*Sleep*, see paragraph (b) below). On the other hand, the majority said that in ordinary circumstances the weather so determined the spacing of the operational effort that fatigue did not normally arise. In fact, one medical officer thought that crews are so conscious that they might become tired that they make allowances for themselves, and so fatigue does not arise in any circumstances. In heavy bombers physical fatigue definitely can occur in a long trip, especially if there is no second pilot, and if the automatic pilot is not used. Small men particularly find the physical exertion required in taking evasive action to be considerable, but this kind of fatigue is dispelled by one good night's sleep. There is a great individual difference in the amount of work which men can perform. The physical fatigue of flying a heavy bomber is limited to the pilot who, as captain of the aircraft, has an added mental load. There was agreement that big men found these planes easier to fly than small men of slender build, and one station commander thought that there should be special selection for these heavy jobs. A squadron commander said that physical discomfort, caused by unsuitable seats, poorly fitting goggles or masks, contributed more to the total fatigue than lack of sleep or pressure of work. Four observers considered that the symptoms of fatigue were largely due to fear and that physical fatigue alone was not an important factor in the stress of operational flying.

(b) **Loss of sleep**

The place of loss of sleep in adding to the load of crews was discussed by 28 observers. Fifteen of these said that lack of sleep existed, especially in the summer, but 13 thought that there was no lack. Loss of sleep may be directly due to spacing of the operations themselves or to factors not directly related to the operational tour, such as unsuitable sleeping conditions, failure to use facilities offered, or inability to sleep in the day time.

The operations themselves do not under average conditions cause much loss of sleep but during periods of intensive activity this may become a serious problem, for ' When crews have been out on a few consecutive nights there is a falling off in efficiency, reaction time becomes slow, and there is liable to be an increase in aircraft losses '. The ease with which crews can make up for lost sleep obviously depends to a great extent on the spacing of the effort. The ideal spacing which has often only theoretical interest, since it is governed by the weather, is discussed under the heading in relation to fatigue and sleep. A station commander said that during the operational tour unevenness of the rhythm of existence makes it impossible to obtain enough sleep even though there may be a sufficient number of hours. He said that after two nights' operations a man must be given a night's sleep. Another said that there was no lack of sleep if operations were not more frequent than on alternate nights.

Arrangements for sleep were thought perfectly adequate on the whole, but because of some individuals' difficulty in sleeping in the day time it was suggested that air crews should have separate air crew sleeping quarters, or that there should be individual cubicles in the quarters. One commanding officer had forbidden the morning broadcast news to ensure quiet for the crews.

Some men cannot adjust themselves to sleep in the day time and every consideration should be given to these people. They cannot become accustomed to the change in sleep rhythm, they are disturbed by daylight noises, and especially in summer the light keeps them awake. 'Some people cannot sleep in the day and during a period of intense operational activity may not average more than two hours. At the end of my operational tour I felt the idea of getting a full night's sleep was marvellous. When you are short of sleep your control is lost.' It was suggested that by reversing the whole programme of day and night during the tour some of these men who cannot sleep during the day after a raid would be taught to acquire a rhythm for day sleep. The point was made that it is the perpetual changing of the rhythm, owing to the variation in the intensity of the operational effort which causes the difficulty.

Ten officers said that the main trouble is that the men will not go to bed. They go to parties and will not make use of the facilities offered to them. A station commander said: "Lack of sleep depends mostly on the individual and his initiative. Officers have excellent facilities and the N.C.Os. often sleep right through to tea time, so if they don't get enough it is their fault". One officer thought that they should be educated to spend a sufficient number of hours in bed after a sortie, and another thought that firmer discipline should be imposed, the N.C.O. aircrew being kept on the stations for fixed periods after an operation. The position is summed up in the remark: 'Taking it all the year round it is mainly their own fault if they do not get enough sleep, but if they do two operations running there is very little sleep for 48 hours'.

Lastly, the sleep of squadron and flight commanders should be considered as a separate problem. The commander of a heavy bomber squadron does not operate often although he spends much of his nights out of bed on the station, but the flight commander not only operates frequently but may have responsible executive duties in the day time. These require his presence in his office in the morning, so that both his night and his day sleep are broken up. The consensus of opinion was that although crews usually have adequate facilities for sleep, of which they often do not make full use, the senior operational officers have too many day duties to ensure ample sleep and relaxation.

(c) Cold and altitude

Seventeen observers dismissed these factors as unimportant under present conditions in heavy bomber crews. The Taylor suit has reduced the hardships of the rear gunner, the only member of the crew who really suffered from cold, unless the heating broke down. The effects of altitude on the rare occasions when they arise are due to individual carelessness or misfortune with the oxygen apparatus, masks, or clothing.

3. Catastrophes

(a) Casualties

There was great disparity in the 48 answers to the question, "What effect have casualties in getting men down?" Fifteen observers unreservedly said that casualties did not affect the men at all or that they did so only temporarily. 'They develop an extraordinary reaction to deaths. If casualties are well spaced out and they don't talk about them, they don't matter at all.' 'They are just one of those things.' 'They treat casualties lightly,' 'Casualties and crashes are taken in a spirit of fatalism.' Eleven thought that casualties invariably affected the morale of the squadron. This disagreement suggests that the influence of casualties must be affected by other factors, and observers discussed features which added to their significance. The more important of these are:—

(i) *The casualty rate.*—Seven officers said that there was appreciable anxiety when the rate was high. 'A bad run quickly gets them down.' 'Loss of crews causes a panic state in the squadron.' 'When the casualty rate is high the men are apt to work out for themselves their chances of survival and when this happens the effects are bad.' On the other hand: 'casualties don't get them down in a period of great activity.' The uplifting effect of activity and successes was mentioned by 14 officers (*Success*, pp. 55–56).

(ii) *Personal losses.*—Often, when changes are rapid, the squadron does not know the missing crew intimately and the loss is impersonal. 'If inexperienced air crews are lost they say "that's tough," but don't worry.' The effect on the squadron may be noticed if casualties include: an experienced man, their reaction being 'if he has gone what chance have I'; a leader, 'my station has lost three squadron commanders in quick succession and the effect on morale has been very bad'; a personal friend in their own crew; if a man has to stand down and his crew is missing the effect on him is disastrous. 'A good crew was lost on their last trip, but the second pilot was attending a court at the time and so escaped. He has since packed up, having only done 10 trips.'

(iii) *Success.*—If the casualties have been incurred to some purpose there are no bad effects. A medical officer said: "Casualties have a direct effect on morale, but if the crews feel the losses have been balanced by success it doesn't worry them." Another said: "When casualties were very high, morale went up because they were getting successes to balance them."

(iv) *The leader.*—Leadership is especially important in this connection. A station commander said à propos of casualties: "It staggers me that they are so unflinching. It must be the squadron commanders." A commander of a day bomber squadron said when the casualty rate was exceptionally high: "I used to discuss the economics and show that the results were well worth it and point out that if one aircraft and crew were lost for each ship, the results were superb." He said his squadron took heavy casualties very well (*Leadership*, pp. 53–54).

(b) Crashes

By the time a crew has reached a squadron the effects of experiencing or witnessing crashes is not great unless special catastrophic features attend it; in fact if a crew 'gets away with a crash it may well increase their confidence.'

(i) *Crashes experienced.*—Factors which increase the strain after a crash are fire; unavoidable or unexplained crashes unrelated to pilot error; personal injury; immersion in the sea; features which match specific fears of the individual.

(ii) *Crashes witnessed.*—Seeing a crash has a worse effect on the crews than aircraft failing to return through enemy action. The crashes which influence the onlookers most are those which occur on the airfield, especially when they are accompanied by fire or explosions. Again the effects are enhanced by uncertainty as to the cause or its possible prevention. The deleterious effects of crashes are caused almost entirely by the man himself anticipating a similar catastrophe, so that the more unavoidable, distressing, or personally related it seems to him, the worse are the repercussions upon his morale.

II. FACTORS AFFECTING THE MAN'S ABILITY TO CARRY THE LOAD

1. The intrinsic factor

The intrinsic factor of individual capacity is dependent upon inherent qualities which are fixed: the problem which arises is that of the selection of flying personnel. Many of those interviewed and especially the most experienced station and squadron commanders dwelt upon the inherent quality of the man as the most important single factor concerned in his ability to succeed in the operational effort, most of them going on to discuss the difficulties of selection for operations during training. One said that in order to be of use to the squadron, a man must be temperamentally suited to flying, and have the right offensive spirit. If a man has these two qualities he will keep going in spite of opposition, his one purpose being to strike hard at the enemy. As he can fly intuitively and has this purpose, he becomes an efficient member of the bomber squadron. If he has not both these qualities he is handicapped from the start, and may well fail to complete his tour. A senior officer with much experience of selection of flying personnel, divided entrants into three groups: those who obviously have the offensive spirit and will prove a success whatever the operational stress; those who hide their temperamental deficiencies behind a show of enthusiasm (these should be weeded out early in training, for they soon show their quality); and (the largest group) the quiet, unassuming, normal men, all of them problems, because although they have not yet developed the offensive spirit it may well be latent, and will show itself after they have successfully completed training—this group produces many great operational pilots. The processes of selection and rejection which have gone on in training, ensure that only a minority of unsuitable men reach an operational squadron (12 observers reported that these are all weeded out in the first few raids). Many of these officers said that these men were not really to be blamed, because they are made of poorer material than the rest of the squadron. Although they cannot be blamed, the result of their inadequacy —failure to accept the load—may have disastrous effects upon the morale of others. The successful members of the squadron have all had to exert some degree of self-discipline in order to stay the course. To some, the load is not great, but to others the same load is almost overpowering, and their self-discipline must consequently be great. It is thus evident that in relation to a man's ability to carry the load, the constitutional, intrinsic, factor is generally held to be of great importance. It follows that prevention of the effects of flying stress should begin with the selection of the right type of man for flying duties. The problem of selection of flying personnel is, however, beyond the scope of this report.

2. Extrinsic factors

The extrinsic factors affecting the man's ability to carry the load may be divided into factors directly connected with flying and factors indirectly connected with flying. The extrinsic factors are capable of modification; this led to discussion of the ways and means of supporting morale and endurance.

(a) FACTORS DIRECTLY CONNECTED WITH FLYING

(i) Confidence in the crews

It was said of a day bomber squadron: 'The crew spirit is the strongest thing I have ever met, stronger than the feeling of brother for brother, or man for wife. If one member of the crew is on an operation and the other two have had to stand down, they don't go off the station, but hang about looking miserable till he comes back . . . . The crew confidence is steadily built up and will then continue, even if to the outsider it appears unjustified. For instance the crew will swear by their pilot and not want to go with any other, even though he is obviously to others a poor one.' This is also said to be true of heavy bombers. 'Crew confidence is often intense and you cannot run a crew without it. The crew should be kept together and strangers should not be put into it.' Crew confidence can be fostered by careful matching at the O.T.U. After they had been crewed up at the O.T.U. and reached the squadron one commander always asked them if they were happy together, but very few said they were not. Sometimes it seemed that a man would not fit in with the rest of the crew and he reshuffled it. All those who discussed this said that they tried to avoid moving anyone out of a crew or interfering with it in any way. Once they have been crewed up, the captain is mainly responsible for keeping the crew together, and their loyalty to him becomes intense. 'If the captain is a man the others rely on, it is a first-class crew.' 'A good captain and a good pilot are both essential, but it is difficult to find both in the same man.' (*Leadership*, pp. 53–54). A further method of fostering the crew spirit is to praise them as a crew, and not as individuals. A squadron commander said that if they came back with a good photograph he praised the whole crew, or gave them 48 hours off.

Of 39 officers who discussed crew confidence 22 referred to the disintegrating effect of one bad member. Air gunners because of their loneliness and inactivity are particularly apt to complain and affect the others The effect of an unsuitable captain is much greater than that of any other member of the crew, and their deterioration under him is much more rapid. For example an experienced air observer, who had never had symptoms while flying, went on a freshman's first two raids and vomited each time. His pilot was changed and he was never sick again. If a man is weak but is an accepted member of the crew the rest will nurse him along, but if he ever seems likely to jeopardise the safety of the aircraft they as a crew will report him to the squadron commander. Each man relies on the rest of the crew to such an extent that the individual members will conceal illness in order to remain in the team.

(ii) Flying training and operational experience

Of the 17 officers who emphasised the importance of flying training in reducing the load, 11 found that at present it left nothing to be desired, and only 2 thought that there had recently been some deterioration in the skill of men reaching operations. The standard to aim at is 'to be fit to fly automatically with all their dash available for the job.' Although they come to the squadron well trained it is difficult to make them continue training, although there are adequate facilities for it in the squadron. (*Operational Inactivity*, page 46). 'They have to be forced to train but the effort pays by giving them more confidence—it is the best insurance policy they can take out.' When a pilot's training has been suitable 'If he meets flak he will take evasive action in a methodical, systematic way, and he will tend to think of hostile ground defences as inferiors, a lower race of mortals than the air crew.' It was stated that 'Adequate training is the most important factor of all in building up confidence, form which arises fearlessness.' Badly trained men, on the other hand, have a greater load to carry and become more fatigued than the well trained.

Operational experience may have different effects on morale: 'It is good and bad, for the experienced man knows more about danger and so discriminates, but he is also apt to anticipate.' Squadron commanders favour the established practice of sending a man as a second pilot for his first two or three operational trips for if he is inexperienced he does not yet know what danger is, and consequently takes undue risks and may not return. With increasing experience he usually 'reaches a stage of professional confidence and keenness.'

Although this confidence is mainly derived from personal experience, it can also be gained from the experience of others and may to a large extent be acquired by personal contacts before the man begins operations.

(iii) Leadership

Forty-five officers (22 general duties and 23 medical) discussed the importance of leadership in helping the man to accept and carry the load of operational flying. There was no exception to the opinion that good leadership was vital and many thought it the most important factor of all. The discussion of leadership in the squadron will be limited to the squadron and flight commanders because 37 of the 45 referred to them specifically, and the expression that 'the squadron commander is the most important man in the Air Force' summed up all opinions. It was evident that all the squadron commanders interviewed had given much thought to leadership and to their personal relationship to the squadron, and that the opinions they gave represented their own experiences. Similarly, the medical officers were describing their observations of the commanders with whom they had worked. They all had definite views on the quality of leadership and the place of the leader, and there was close uniformity of opinion. One medical officer had seen 22 commanders of his squadron, most of whom were first-class leaders. In discussing the personality of the ideal commander his final opinion was that 'No two were ever the same.' A very experienced wing commander said: "One man is thick headed and has no imagination, another is nervous but drives himself on, another will beat anything up, another is just an easy-going jolly nice fellow." Each of these if he has the personality to lead, may be a perfectly good squadron commander.

Nevertheless, some qualities, which will be summarised, were widely held to be desirable in the leader of a squadron. He must have had operational experience. If he had not completed a tour he should quickly show himself an efficient operational pilot. 'He should be a good steady man who goes to see what it is like, they don't like being led by a wild pilot.' He should not pick and choose his sorties for the crews will soon notice, and one commander who was acutely aware of this, always told the adjutant a day or so beforehand, before the target was known, that he would be going on the next sortie. The commander ought occasionally to go on difficult raids, and should also go out when losses are heavy or morale low. In operations he should always set an example: 'He should fly just enough to be one of the lads and to share their hazards.' He must be keen and have plenty of initiative and drive, his whole interest being in the squadron. 'The leader must be prepared to make the war his whole interest and get on with it.' He is expected to have a personal knowledge of all the crews and to mix freely and be friendly with them. It is important that the leader should be accessible to the crews and listen to them when required to do so. Rather than appearing too sympathetic and kind he should be hard, and in all matters connected with flying must be fair and exert discipline, not giving an inch where duty is concerned. (*Discipline*, pp. 57–58). Above all, whatever his other qualities, or his type of personality, he must be a leader. 'A very good pilot may be a bad leader.' This quality of leadership becomes particularly evident when things are going badly. 'He was at once active after a period of very heavy casualties, organising intensive training, and keeping the spirit of aggressiveness going.' 'When things are going badly he speaks quietly and with confidence.' 'He should take a trip at the right moment when morale is low.'

The emphasis on the leader's place in maintaining squadron morale was such that 34 officers described the fortunes of the squadron in terms of its commanders. A good one will build it up to a very high level of efficiency—

'Good leadership is calculated to drop all the bombs on the target.' 'The backbone of morale is a good squadron commander: a bad one will have an immediate effect.' 'I have had several cases of lack of confidence. They usually occur in epidemics, and when an epidemic occurs it is usually due to a bad squadron or flight commander. It became known that a squadron commander wouldn't fly operationally and five cases occurred in the first fortnight.' 'I have seen men crack because they had no confidence in their flight commander, who was really quite a good chap." A station commander said: "Leadership is all important. A bad squadron or flight commander makes all the difference to the crews and you can see the efficiency fall and consequent breakdown occur. This is usually due to attending too much to administration and not taking enough interest in the men."

(iv) Spacing of effort

Thirty-three observers, 21 of them general duties officers, discussed the effect upon the crews of variations in the spacing of the operational effort. The intensity of the effort varies with the frequency of the raids and with the type of targets. Its effect depends largely upon the extent to which it interferes with sleep and recreation. (*Fatigue*, pp. 47–48 and *Sleep*, pp. 48–49).

Frequency.—The spacing of the raids in heavy bombers is usually determined by the weather and moon; 18 officers gave their views on the ideal spacing from the point of view of the crews. They were concerned with the maximal effort in a time of intense activity, and with the most efficient spacing throughout the whole tour. Two thought that during a period of *maximal effort* it is possible to do three trips on consecutive nights without a fall in efficiency, so long as there are suitable arrangements for sleeping and feeding, but three others thought that even in exceptional circumstances this is too much, two consecutive nights being the most to be asked of a crew—'After two nights' operations a man must be given a sleep'. 'Two days on and one off is about the limit they can stand.' They considered this point important because "If there have been many operations in a short time the crews don't fly so well". 'They get tired and don't find the target.' Only one considered that two consecutive nights was excessive, but one medical officer thought that "After two nights on, one night in is not enough to catch up on". Fourteen officers gave opinions upon the ideal spacing of operations in *ordinary conditions*. One considered alternate nights to be satisfactory but two thought this excessive. The more usual opinion was that two nights on and one off, a spacing of three times a week or alternate nights for not more than 10 days was feasible. One said the ideal was one night on and two off, but this was not nearly the most they could do with efficiency, while another gave the careful opinion that with two nights on and then two off, the man was able to have a good night's sleep, and a late evening for relaxation, so that he could go on indefinitely. Another said that with one night off only it was impossible to get social relaxation as well as a good night's sleep. (*Sleep*, pp. 48–49). Five officers said that the load of the tour was greatly diminished by keeping steadily at it, in order to get the effort over in the shortest possible time. A long drawn out tour is very demoralising, and the habit of operating is hard to acquire and easy to lose. 'It is much less strain to finish the tour in six months than to drag it out for 12.' 'It is best for them to operate frequently and regularly. Three nights in a row is too much, the ideal is one on, and one off and one for training or alternatively two on and two off. With alternate nights they never get relaxation, they are either operating or sleeping. The best crews like to keep to their job and to get their tour over.'

The type of target.—' It is of great psychological importance that a crew who have had a series of attacks on heavily defended targets should have a chance or two over easy targets before going back to the stiffer job. ' ' Endless trips on a place like Brest or Essen get them down. Quite apart from the difficulty of the target it is a good thing to mix the targets up. There is nothing better for morale than a change of trip, even though the target is heavily defended, because they like something novel.' This view was shared by 15 officers. All except three of them thought it advisable to distribute easy trips or novel targets through the squadron. The three officers who dissented were in day bomber squadrons and they found this ideal to be impracticable because the battle order is announced before the target is known.

(v) Success and recognition of effort

The place of success in restoring morale when casualties have been high has already been mentioned (*Catastrophes*, pp. 49–50). The value of success known to crews was discussed by 33 observers, seven of whom considered the effects of success and 19 of lack of success. Of the total, six thought that the crews were not greatly concerned about the success which attended their raids and that lack of success did not affect them seriously. On the other hand, 18 thought this factor made a great difference to them. Success known to the squadron bolsters up morale—' After a good night they come back rubbing their hands. After a bad one it would have been much better for their morale if they had not gone.' The stimulating effect of known success is more evident in day than in night bombing—' Success makes a particular difference in day bombing because you can always see what happens and it is a thrilling sight to see a hit.' ' The odds of finding a ship are 1 to 3 so that it is always likely and it keeps their tails up.' The effect of failure to observe success may be unpredictable due to bad visibility. If it is night bombing, it may cause despondency, though ' not seeing the target is part of the job and so it doesn't worry them.' If due to actual failure it may have bad effects—' New photographic methods show up their failures and add to the bad effect of the failure.' In day bombers it is similar. ' When the *Tirpitz* was bombed we lost eight crews without any result and the effect was disastrous.' On the other hand the leader of a light bomber squadron engaged on attacking aerodromes at night said ' Our targets are so hard to hit anyway that all we can do is always to believe we've hit the right one '. Summarising the divergent views it seems that :—

> Known success gives a great uplift.
> Failure to observe success bothers some and not others.
> Actual failure has a demoralising effect if associated with losses, but otherwise it is often accepted as part of the job.

Recognition of a man's effort was discussed by 28 observers. Six of these talked about the value of *praise* give by the squadron and flight commanders, particularly early in the tour. Constant good work is apt to go by unnoticed, and a pat on the back and an occasional word of praise is greatly appreciated. ' Praise should not be lavish but should be used with great judgment.' ' It matters greatly at the right moment.' ' Lack of praise for brave failures makes them feel that they are not being appreciated ' but ' a bit of quiet praise from the squadron commander pushes morale right up.'

Of 23 people who raised the question of *decorations*, only two thought them unimportant for the efficiency and welfare of the squadron. All the others thought that *immediate awards* were particularly valuable, because the award came through while the man was in the squadron, so that all the crews got uplift from it. The only comment in relation to immediate awards was upon the difficulty in including the whole crew in the award since some, especially the wireless operator and air gunner, may play a passive part. This was also mentioned by three officers in discussing awards in general.

Non-immediate awards caused some discussion. Twelve were satisfied with the present arrangements in their respective groups, and three of these even thought that too many decoratious were given, while six had criticisms to offer. Four officers thought that greater recognition should be given to good all-round performance by the whole crew. This good performance is not always recognised—' The mere fact that we have not been beaten up leads to our not getting any gongs, whereas it is really an indication of our efficiency. If we find our targets without casualties it is really a good show and this should be recognised.' The most frequent observation made was that an insufficient number are given. The arguments were that any man who has completed a good tour without ' putting up any blacks ' certainly deserves a decoration. All the squadron commanders who said this attempted to put their views into practice. One said that as only 20 per cent of the flying personnel were posted away from the station having completed a tour they certainly deserved something. On the other hand, four said that the D.F.C. and D.F.M. should be reserved for distinguished flying and in order to give recognition to a greater number of praiseworthy operational air crew, another form of award should be made. A Service ribbon to be given at the end of the tour* with a bar for an additional tour or a badge or stripe on the sleeve similar to the wound or overseas service stripe of the last war were suggested. The purpose of this was to give everyone something to work for, instead of the uncertainty of a decoration ; to distinguish those who had flown operationally from the others ; to enhance their prestige as instructors at O.T.Us. and to preserve the D.F.C. and D.F.M. for outstanding gallantry. Against these arguments were advanced the opposing views that an operational tour represented only the man's duty, and was therefore to be taken for granted ; and that distinguished flying is needed to complete a tour. Another point raised was that non-immediate awards do not often come through until the man has left the squadron, so that they have no personal value for the crews and their effect upon morale is consequently reduced.

(vi) Confidence in aircraft and maintenance

Of 27 officers who were asked " What part does confidence in the aircraft play in affecting the load ? " 16 said that in their squadron confidence in the aircraft was as high as it possibly could be, eight that it was very important in maintaining morale, and four that loss of confidence was accompanied by a great deterioration in morale. Those who referred to loss of confidence in a type of aircraft mentioned specific reasons for this. Some said that just after conversion to a new type, teething troubles occurred and confidence was low ; this invariably led to a deterioration in morale. Specific anxiety was mentioned ; observers were anxious about belly landings. For example, in Bostons, when it was known that these could be accomplished safely, the confidence of the whole crew went up. Mechanical failures when unexplained may cause disruption of morale in a squadron. A medical officer quoted an example. A squadron were unable to find the cause for repeated fires in the engines. ' We were facing a show-down in morale, but happened to convert to another type in time.' The unexplained mechanical failures are most potent. A squadron commander said : " Confidence in the aircraft can be maintained by the C.O.,

* Provided shortly after presentation of this report by the award of the General Service ribbon to men who had been engaged in operations from home based stations.

squadron commander and engineer officer, whose main job is to clear bogeys away. When things go wrong they should at all costs explain, even if the explanation is not really correct. The men are faddy about their aircraft, and if something goes wrong which they can't understand they get very depressed and anxious.''

Besides confidence in a type, they have *confidence in one aircraft* and always like to fly that one 'however ropey it is'. They easily develop superstitions, and will not fly a particular aircraft for foolish reasons. For instance, there had been a series of fatal crashes in H. for Harry, and after that no one in the squadron would fly aircraft with that letter. Once great confidence has been established it persists, often quite illogically.

Eight officers also emphasised the place of *confidence in aircraft maintenance*, saying that it may affect a crew considerably. It depends primarily on the engineer officer and after that on the ground crew itself. A squadron commander encouraged his air crews to know their ground crews personally so as to learn what good reliable men they were. He complained that it was hard on the air crews that so many respected mechanics were being posted away from them. 'Confidence not only in servicing the aircraft, but in the organisation of the whole station is most valuable for morale.' Some of the factors influencing this will now be considered.

(b) Factors indirectly connected with flying

(i) Discipline

Twenty-six out of 37 officers who discussed discipline in relation to operational efficiency and the welfare of air crews thought that some form of discipline should be imposed on the ground. They all differentiated sharply between ground discipline and discipline in the air. Although there were divergent views on the place of discipline among aircrews while on the ground, no one hesitated to insist how important flying discipline is. This was emphasised particularly by commanders of day bomber squadrons. 'Flying discipline is most important because most of our work is done in formation.' 'I had a man who had to be told more than once about keeping formation, but he thought he knew everything. If he had been trained to unquestioning obedience he would not in the end have been killed.' A commander of a heavy bomber squadron said: 'A good squadron will have its own self-discipline in the air.' Another said "The men who are lost are those who forget their training or disobey orders." Flying discipline differs from that on the ground, for 'in the air things are different, there team spirit counts and they can afford to be matey, but if they have discipline behind them this is all right'.

Fifteen officers thought that discipline imposed on the ground was reflected in efficiency in the air. 'Discipline inculcates respect for the leaders, orderliness and method, personal esteem, and the realisation that orders have to be carried out. The last is the most important. When I wonder if they are getting right to the target I think that if they are obeying orders on the ground it is likely that they are similarly obeying orders in the air and reaching their objective.' A station commander said: "A man who is not taught to be methodical and who forgets things on the ground forgets things in the air." Many men have been lost through this. It is a question of habit and self-discipline. Before they take off, if a routine has not been inculcated, mistakes and omissions are made at the very beginning, and later in an emergency through lack of routine, further mistakes are made and confidence is lost." Apart from the obedience inculcated by discipline on the ground, the fostering of self-discipline and self-respect was mentioned by nine officers, two of whom made these remarks: "good captains and good men are 90 per cent smart in my squadron," "If a man is slovenly on the ground the odds are that he will be slovenly in flying. You can see this in the way they keep their rooms and in the way they fly." Two officers thought that ground discipline did not increase flying discipline. 'The air crews may be quite undisciplined and yet be first class.'

Nine officers, although they thought that discipline on the ground was reflected in the efficiency of flying, thought it inadvisable to impose discipline on air crews. 'They don't like it, and you get far more co-operation in the air without it. Besides, when a man's been shot at a few times he is, in his own eyes, entitled to a bit of freedom.' 'You must lead air crews, not force them—they don't want too strict discipline.' One senior station commander, although convinced that ground discipline was reflected in air efficiency had, through experience, arrived at the conclusion that distinction between ranks in air crews would be better abolished. Three others agreed with him. They advocated a common rank and common messes for flying personnel. Some favoured a considerable measure of freedom in the relations between officers and sergeant aircrew when together, but added that for the sake of order and management and for example to the ground staff the crews had to comply with the usual rules of discipline while on the station.

Only three of the 26 officers who advocated firm discipline wished to see rigid parade-ground discipline imposed, and only five recommended any form of parades and drills for air crews. Four said categorically that this is undesirable, and six thought that all attempts to enforce a system of ground discipline should be suspended during a period of operations. The forms advised ranged from that of a peace time service to 'compliance with orders and a respect for his seniors'. The aim of the great majority was summed up in the remark 'You can have outward form and no discipline, and discipline with no outward form. If the second type can be inculcated, well and good, but usually something more concrete is needed'. The more concrete proposals were insistence on personal smartness and cleanliness on the stations and in the mess, with respect for leaders; and strict and immediate compliance with all orders with instance on punctuality at all times.

(ii) P.T. and games

Thirty-six officers, 14 of them medical officers, discussed the value of regular exercise for air crews. Twenty-five recommended some form of regular exercise, but ten of these thought that games should be quite informal and suited to individual tastes. 'Games are good if they are not too highly organised.' They deplored compulsory exercise, and advised rather that team games should be arranged between officers and sergeants, and golf, tennis, squash or swimming should be encouraged. Five of them thought team games were quite unnecessary. Eight thought that the crews should not be coerced into exercise during an operational period, and that games became irksome unless the weather is bad, because air crews hate to be driven to any form of non-essential exercise. Of 20 officers who mentioned physical training, 11 thought it not worth pushing. 'P.T. is no good—it just browns them off.' No one was prepared to enforce compulsory P.T., but the general opinion of those who thought it valuable was that it should be instituted in periods of prolonged operational inactivity. If instituted it should be managed by a well trained tactful instructor.

Nine thought that regular exercise was unimportant. 'They should be fit enough with their ordinary exercise, walking on the station, and exertion in the aircraft.' Seven officers said that there was no need to be athletically fit to be efficient in bombing raids. A station commander said: "There is no great need to keep air crews in strict physical training, what you want to be fit for is flying, and the way to keep fit for flying is to go on flying". Even those who advised games for air crews did not ask for great physical fitness. One summed up the position by saying: " The crews need not be athletically fit but they whould be well enough to keep their limbs supple and their eyes clear. It is good for them morally, mentally and physically". On the other hand, one thought that being fit to play a game made for comfort at altitude and another commander of a day bomber squadron said he kept fit in case he ever had to stand exertion and exposure after ditching.

(iii) Living conditions

There was a great contrast between the opinions of 20 officers depending upon whether they were on permanent or temporary stations. On permanent stations living conditions were in general calculated to reduce the load, but in the temporary stations the hardships experienced by air crews living in dispersed sites, especially in winter, were thought worthy of comment by six officers, especially the distance of the sites from the administrative block and from the bath house. N.C.O. aircrew had in all weathers to make several journeys to and from their dispersed quarters—to briefing, to a meal, to the sortie and, on return, for a bath before resting. They considered that this, with the absence of any water on the sites, adds greatly to the strain of operations. 'In winter they have to come in to be briefed, have a meal, go out to the sites and then back. They are damp and dismal. In the site there are no washing facilities and there are no fires at all. There is also no one to look after them.' Suggestions upon factors affecting the load in both types of station related to closer supervision of air crews' quarters which the crews tend to leave dirty and untidy, and to care in the disposal of air crews in the quarters. It was desirable to have all the crew in the same room, but not more than one crew in each room lest the effect of casualties be accentuated. It was also desirable to employ a whole-time, permanent A.C.H. servant in the crew rooms, to be responsible for hot drinks, general comfort and drying clothing. An extension of the drying-rooms with a communal room replacing lockers would be possible if a man were constantly in charge to prevent pilfering. The flying clothing would thus be drier and better cared for. The A.C.H. would also be responsible for the vacuum flasks and hot drinks for the sortie. Sleeping conditions have already been dealt with (*Sleep*, pp. 48–49). Ten officers who mentioned feeding arrangements were totally satisfied with them. Two said that in the aircraft they kept all the sweet chocolate and biscuits to eat next day. They prefer a plain or bitter chocolate, chewing gum and boiled sweets.

(iv) Recreation

Off the station.—The 29 observers who discussed recreational facilities laid emphasis on the importance of getting right away from the station at regular intervals. Thirteen said that with the present transport difficulties it was not possible for all the air crews to reach the nearest town each week. Because they thought it so important, the commanders of these stations made strenuous efforts to achieve this. Five mentioned the necessity of a crew knowing beforehand whether they would be operating the next day, so that they could plan their evening accordingly. In this connection the squadron release day was spoken of with deep appreciation, and reference was made to the ill effects of its cancellation. A commander said: " When they're off the job they should have as much recreation as possible. Once every eight to ten days a squadron should have a day off, whatever the work. The crew will last longer and, though the effort may be submaximal, the long term economy will be worth it ".

On the station.—Now that transport facilities are difficult, greater effort should be made to provide recreation on the station. Three officers suggested an air crew club for the use of flying personnel. One suggested that it should have a bar and reading room and that, of the non-flying personnel, the medical officer only should have access to it. It was thought this club would simplify the recreational problem in the station.

(v) Leave

Every one of 27 officers considered the present leave regulation for flying personnel perfectly adequate. In practice it is not always possible to give full or regular leave during busy moon periods, or when the squadron strength is depleted. Some opinions given about leave were :—

It should be regular (not always practicable).
It should be known to the crews well in advance so that plans can be made.
It should not be too long.
It should be spent in suitable environment.

Opinions varied as to the maximum during operations. Most observers suggested about seven days. ' A man is silly to take more than ten days. If he takes more than this, he loses contact with the technique and with current affairs in the squadron. He does not know where things are and has to pick up the threads again.' The highest figure given was 12 days. two squadron commanders preferred to limit the leave period to four days at a time during the operational tour.

' The benefit depends on the mental aspect of the people with whom they spend their leave.' ' Sympathetic relatives may have a thoroughly bad effect.' In this respect, air crews from the Dominions have a special problem. ' Rest houses like country clubs should be provided for Colonials who have often nowhere to go.' Apart from regular privilege leave during operations, leave should only be given if the man is really fatigued. ' If a man is genuinely tired he gets ten days, if he is shaky he has none.'

(vi) Domestic factors

The part played by domestic worries in adding to the load was described by 18 observers. One medical officer said that they contributed to 90 per cent of cases of breakdown, but another thought their effect trivial. The others all considered that they contributed materially to the load. The Factors mentioned were :—

Marriage during the tour.
Pregnancy, especially in the early months and at full term. Two observers suggested compassionate leave at the time of the confinement.
Financial worries.
The family's anxiety. The wives worry and transfer their worry to the husbands during leave or in letters.
Much more rarely, very real anxieties or catastrophes such as a mental breakdown or serious illness in the family, particularly the wife.

The effect of these anxieties depends on the man's attitude—he may use them as an excuse not to fly, or he may put his duty before his family, and on the wife's personality—in this respect sergeants' wives in general tend to be less helpful than officers'.

Living out.—Family affairs are so likely to interfere with duty that 23 officers said that all operational air crews should live on the station and their families should be out of immediate reach—30 miles was given as an arbitrary minimum distance from the Station. The crews should go home on leave, but not at other times. One squadron commander who had lived out on his first tour said that his wife worried a bit but it did not upset him—'but considering all kinds of wives it is best not to make exceptions, but to have all air crews living in'. There were no dissentients from this view.

3. The rôle of the medical officer in relation to the load

The place of the medical officer in relation to operational crews was discussed by 40 officers, of whom 26 were in the general duties branch. Every one of the 40 observers agreed that the medical officer had an important part to play in maintaining morale in the squadron. Regarding this, such observations as 'The medical officer is the most important man in the squadron' and 'The squadron medical officer is the most important doctor in the Air Force', were not exceptional. In order to help members of the squadron, he must know them personally, and must have their respect. The crews should be prepared to confide in him and to accept his advice, however hard it may seem. On his part, he must have the confidence of the squadron commander and must adopt an attitude to squadron affairs, and particularly to operations, which is consistent with maximum operational efficiency. A squadron commander said: "One good medical officer used to make the fellows go to him because of his outlook, but the doctor was never soft. He used to shoot them back to me" (*Rôle of the medical officer in detecting the effects of stress*, pp. 37–38).

Station and squadron commanders were emphatic that medical officers should be carefully chosen for this work, and they agreed very closely upon the most suitable type of men for it. They preferred a man with fairly wide experience, not one newly qualified. His age should be around thirty years, and he should be mature and have sufficient savoir faire for the crews to come along with their domestic and social troubles. Sometimes a younger man is able to fill this rôle, and then he has the advantage that he is more likely to play games and enter into a party. Above all, the squadron medical officer must be a good mixer. It is easier for him if he is not teetotal, but though he should drink with the crews he should always be a little behind them and should not be the life and soul of the party, in case he should lose their respect. He must be a practical man who can cope with an emergency, so that he always has the crews' confidence, but for this he need not be a good academic physician. In order to maintain their confidence he must always be available when emergencies may arise. He should invariably be present at briefing, take off, return and interrogation, and should mix freely in the crew rooms. High praise is 'Whenever there is flying the doc is there'. This entails living in the station and taking recreation with the squadron in the crew rooms, the hangars, in the air, the messes and in outside parties. Although liaison between the medical officer and the commanding officers should be as intimate as possible, it should be outside the knowledge of the crews.

Eight officers thought that the usefulness of the squadron medical officer would be enhanced by careful selection and also by some form of education in squadron affairs. It is important that the medical officer should be persona grata on arrival at a squadron. It was suggested that if he had had no squadron experience he should first be attached supernumerary for instruction to another squadron before being posted to his own.

Being readily accessible to all members of the squadron he is in a privileged position and will soon have the crews' confidence. 'If the air crews look up to him and respect him, they will trust him, and be in his confidence with very beneficial results. The failures are nice enough men, but they are fish out of water.' An experienced and successful medical officer said: "The actual approach depends on the personality. He should work in close collaboration with the squadron and flight commanders, but this should not be evident to the men. By his attitude and approach he will inspire their confidence." (*Rôle of the Medical Officer in detecting effects of stress*, pp. 37–38; and *Operational Limit*, pp. 38–40).

The crews should look on the medical officer not only as one of themselves, but as their doctor. They will bring their small complaints to him, and they will expect him to be available in times of disaster. When they bring their anxieties and fears to him, or when by word or sign he sees evidence of deterioration, he should act promptly, for 'Decision and acceptance of responsibility in these cases is the medical officer's supreme task.' The men will make confidences to the medical officer that they would hide from others, and some will even go to a medical officer, knowing that he will discuss the problem with the squadron commander, rather than go to the squadron commander himself. In this way the medical officer obtains a unique position in the squadron, and if he uses it properly can have a great influence upon squadron morale.

III. CONDITIONS PECULIAR TO DAY BOMBER SQUADRONS

(*Appendix to FPRC* 412(f))

Sixteen officers of day bomber squadrons, nine general duties and seven medical, were interrogated. The substance of their observations was the same as that obtained from the officers of heavy bomber squadrons and much of the material gained from them has been incorporated in the body of the report, but there were nevertheless some observations peculiar to day bombers which have not been mentioned.

The signs.—There are unusual facilities for observing a man's operational efficiency in day bombers. Two squadron commanders said that they summed up a man in his first five trips by the way he behaved in formation flying, and after that if his performance changed they kept an eye on him. They thought it significant if a man who had been keeping his place in formation began to keep too close, or at the sight of danger tended to break formation. It is so dangerous, however, for aircraft in day bomber squadrons to break formation and return to base alone, that it is unusual to find men who are showing the signs of stress turning back complaining of mechanical failures. This is a marked contrast to the situation in heavy night bombers.

Experience.—The value of training and operational experience is especially great in day bombers. 'Experience counts for an enormous amount, because the seasoned man is able to cope with any emergency, as he has had it before. More men are lost by making mistakes than by bad luck.' The forms which the emergency may take are more varied than in night bombing, since they include all the hazards of aerial combat and the tactics of close formation flying.

Leadership.—From this it follows that the leader has an important function in leading the squadron personally into combat, in addition to his duties relating to squadron management on the ground. While in the air he is in much more intimate contact with his squadron than is the night bomber squadron commander, and is in fact in the forefront throughout the raid. Consequently as well as leading difficult raids for the sake of morale, he should also lead important raids where his experience will count for so much. His steady leadership is important and since experience counts for so much the wing commander and his crew should be both very good and very senior in operational flying. It has been said : " A good leader makes the squadron. " A group commander said that leadership mattered more in day than in night bombers. He therefore advised picking the leaders mainly upon their operational records, irrespective of age. ; " this means picking young men who will always be on the job themselves and who have got personality and can get the best out of people." A wing commander said : " All our operations are team shows, and nothing is individual, so that the example of the leader is all-important."

Second tour.—As leadership in day bombers involves the ability to lead a formation into operations and as experience is so important, general duty officers of day bomber squadrons laid special emphasis upon the importance of regaining tried men for second tour. Having urged the necessity for conserving a man for an efficient second tour an experienced wing commander said : " An added reason is that the great snag in day bombing is to get hold of good leaders, who are much more important to us than to night bombers. " It was this officer who thought it feasible by careful nursing to get a good man back for three short tours, rather than two longer ones, his object being to prolong the man's period of leadership. A medical officer said that the experienced men who came back efficient and at the top of their form became the officers of the squadron and by their obvious superiority soon became flight commanders. From then on their value was greatly enhanced.

Operational limit.—It has been shown in the body of the report that the main object of an operational limit is to secure a man's return for a second tour with unimpaired efficiency. The officers of day bomber squadrons, as has been shown, all stressed particularly how important this was in their Group. They consequently had decided views upon the operational limit. Every one of the 13 officers who discussed an operational limit in day bombers said that the universal application of a fixed limit was impossible. The reasons were : the type of work varies so much ; the rate of loss and degree of success is so unpredictable ; the amount of stress to which a man may be subjected on a fixed number of trips or hours varies so enormously ; the men themselves vary so much in their response to the stress.

One said that there should be a fixed maximum, and two that there should be a maximum for each type of duty. This should be within the reach of the best man, but the individuals should be taken off while they were still fit, the limit only being used to prevent over-working the exceptional man. They all said that the limit of 160 hours was impracticable since no one ever reached it. A squadron commander of great experience said : " No one has ever reached the 160-hour limit, because only one man has completed 28 trips and the limit on an average would mean about 56. " There was unanimity—whether a maximum be fixed in hours or sorties—that the length of a tour depends upon the individual. ' You can't limit anyone in a particular manner. There are a lot of good chaps who have done 20 trips, come off, and who were good for a second tour, but if they had gone beyond 20 they would never have come back. It is the job of the squadron commander more than anything else to watch the individual from this point of view. It is best to take him off a bit early so that he will come back for a second tour, but in day bombers you must leave it to a large extent to the individual. There should be a maximum for any particular kind of work but the man should not know when he is coming off. The operational performance of crews goes steadily uphill to a peak. It then levels off and later in the tour begins to go downhill again. The men should be caught at the peak before they begin to crack up. It was therefore impossible to keep a hard and fast limit, but it would be well to have a very flexible scheme with a known limit so that they know when they are going to get their rest. It would be good to make an arbitrary limit of 25 to 30 trips in order to guide the squadron commander, but some people on day bombers should be taken off long before this. If there is no maximum, the very keen crew will go on indefinitely and get an enormous reaction in the O.T.U. and be no good afterwards.' The case was quoted of one excellent man who in his first five trips had 'a hell of a hammering' and simply had to be taken off, having completed his tour of duty. Three officers suggested an arbitrary minimum, below which if a man is taken off the reasons must be given.

The suggested mechanisms by which the station and squadron commanders together with the medical officers may determine the end of the individual's tour have already been described in the body of the chapter.

Operational conditions.—The *depth of penetration* into enemy territory, particularly Germany, adds greatly to the strain of a raid. The effect which the particular target has upon the crews depends upon the amount of flak encountered over it.

Heavily defended targets soon become known and the anticipation of a raid on one of them may consequently have a demoralising effect. The intense strain of shipping beats is similarly based on the fear of flak. In day bombing the *weather* does not add greatly to the stress except by postponing operations (*Operational Inactivity*, p. 46).

Operational inactivity.—Fourteen of the 16 officers said that operational inactivity always causes a fall in morale. 'Inactivity is one of the worst things, you must keep working. Last summer the losses were terrific, but there was not nearly the fall in morale that there was in winter inactivity.' The crews soon get tired of training during a period of inactivity and they need other forms of occupation and recreation to keep up their morale. Two squadron commanders described the efforts they made to keep their crews training during periods of operational inactivity, both to occupy them and because of the importance of efficient formation flying. It was one of these officers who said: "training is the best insurance policy they can take out." *Standing-by* has a similar demoralising effect, but here the anticipation of the sortie adds to the stress. If the sortie is cancelled after a prolonged standing-by the effect is even worse. (*Anticipation*, pp. 45–46.)

Physical factors.—*Fatigue* and *loss of sleep* do not exist in the ordinary course of events but if crews are working very hard they may become tired for a short while.

The *critical points* in the tour of a day bomber are the first few trips, as in heavy bombers—'in the first few trips they go out and see nothing and are disappointed or they get a bad doing and are a bit worried'; at about the 12th to 14th trip 'a man will work himself up to about the 12th op. and then begin to think he has done enough and wants a rest.' 'They begin to feel the effects at the 12th to 14th trip but this depends so much on the type of operations'; after any particularly unpleasant incident; 'late in the tour, when signs of deterioration are present.' A squadron commander said: "the first trip and the last couple are the worst". Reference to the main report shows that these critical points coincide closely with those given for Bomber Command in general.

CHAPTER V

PERSONAL INVESTIGATION OF PSYCHOLOGICAL DISORDER IN FLYING PERSONNEL OF FIGHTER COMMAND

by

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Introduction

In the main, the signs by which the effects of flying stress were recognised were similar in all the commands, many of the factors which contributed to the load were common and the more general factors which affected the man's ability to carry the load were of course identical. The place of the medical officer in detecting the effects of stress and in preventing their occurrence was similar, and the trend of application and criticism of the operational limit and the form of relief employment was uniform in the commands. There were, nevertheless, points of difference in detail which depended upon the different conditions of operational employment which should be described. These differences can readily be fitted into the general framework of Chapter IV. The present chapter and Chapter VI should therefore be read against the background of Chapter IV.

1. The signs

Loss of efficiency.—Loss of efficiency is more easily recognised than in Bomber or Coastal Commands, for the squadron commander has direct observation of his flying personnel in the formation flying of operations, as well as upon the ground. Thus, lagging in or breaking away from formation may be noticed. Deterioration in flying, bad landings, and general carelessness were commented upon—' His flying isn't as good as it was . . . he begins to lose his appreciation of danger and thus either gets killed or else merely piles up.' The introspective accounts of deterioration given by some of the squadron commanders were also coloured by the nature of their operational duties.

2. Facts noticed, but not reported, by the man himself

Common to all these stories was an account of the development of *fear* to a degree which called for an increasing effort of will to control it. Some degree of fear was admitted as natural and stimulating, increasing alertness and sharpening judgment. Any effect fear might have had in claiming attention and impairing efficiency was in the earlier stages of the operational career offset by the interest of the job, the desire to do well at it and perhaps win a decoration, and the offensive spirit. The experience of a few successes added to the weight of these balancing factors, and the balance was such that once airborne the pilot was relatively fearless. The cumulative effects of stress, both mental and physical, weakened the inhibitory effect of the balancing factors, so that fearlessness was gradually lost. An effort now had to be made to control fear. One officer told how in the Battle of France he knew quite well when he had had enough ; he was so frightened that he sweated every time he got into an aeroplane and couldn't sleep ; he had to carry on as there were no reliefs. (After a period of rest he did brilliant work, gained the D.F.C. and bar and since he was interviewed has won the D.S.O.). Another described himself as getting into a state in which you don't care whether you are shot down or not : " If the King had come down to look on no one would have bothered." He thought that a number of pilots were lost in the Battle of Britain from getting into this state. Another noticed that he was becoming jumpy and irritable, and that he had a sudden craving for leave, though previously he had not wanted it or taken it. Another found himself waking tired in the mornings, and feeling jumpy when a show was on. Another stated that on his first tour he never thought of his personal safety, but rather enjoyed it. He felt the physical strain (of the Battle of Britain) but was mentally unperturbed. At the start of his second tour he still felt keen and had no qualms whatever, nor any thought for himself. Gradually thereafter he reached a stage when he had to force himself to go on operations with a smile and while on the job felt very bad (enough, he thought, to interfere with his efficiency). Then he became aware of continued concern for his own safety. It became a great strain to preserve his composure. He felt he was becoming a coward, which he had never been before. He argued to himself, however, that real courage was the ability to overcome natural fear in the presence of danger and forced himself to carry on. Finally he reported his state to the medical officer and was given a rest. (This officer had already won the D.S.O., and D.F.C. and bar.)

3. Operational limit

The agreement upon signs was followed by similar comment upon the 200-hour operational limit, which was on the whole considered to be satisfactory. Those who criticised it pointed out that no account was taken of the stress encountered in the 200 hours, whether it occurred on sweeps or convoy work, whether in long or short trips over the sea, with shallow or deep penetration, and whether or not engaged in combat. Furthermore it takes no account of the length of time taken or of the individual capacity to endure the strain.

4. The load : operational conditions

There are special loading factors in day fighters, particularly the nature of the operations, involving long sweeps over the sea and over enemy occupied territory, often with deep penetration and anxiety over petrol shortage. Repeated anticipation after briefing and cancellation and long hours of immediate readiness were generally considered to be a greater load than actually going on an operational sweep. Such an opinion as : ' The greatest strain is hanging about before operations and having them postponed—they get keyed up to a pitch and then brood '—was characteristic. Of rather less moment is the demoralising effect of long periods of operational inactivity usually enforced by bad weather.

5. Physical factors

The physical factors incriminated were a little different from those blamed in heavy squadrons. Fatigue and cold were important, but the cumulative effect of flying at high altitude was mentioned repeatedly. ' You are tired, limp and cannot be bothered, so you sink in a chair, your muscles feel flabby, you have not the physical energy to pick up a book—four low patrols are not too fatiguing, but after two climbs to 30,000 feet you feel absolutely weak and washed out, and just want to go to bed and sleep.' Idiosyncracy to this form of deterioration was recognised by some.

6. Training and experience

In day fighting particularly flying training and operational experience were considered vital, for to be efficient on a sweep a pilot must be free to devote the whole of his concentration to combat. If his flying is to serve him at its best on these occasions it must be perfect, and automatically perfect. In order to obtain this perfection he must practise assiduously. Similarly operational experience was invaluable.

The value of operational experience was discussed from several angles by seven observers. It was stated that the first sweep was a strain but ' if in your first few sweeps there is no action you may become over-confident and think there is nothing in it. You need a good fight to get experience.' ' Most people who are lost are bumped because they don't obey orders. This is due to over-confidence resulting from inexperience.' One station commander thought it very important that the novice should if possible go on simple jobs for the first few trips so that he could obtain his early experience gradually: " If he gets on a deep penetration for his first trip he cannot tell the difference between a Hun and a Spitfire, keeps looking behind and seeing things, may get separated and have to battle his way back. This may shatter the average chap, though a man above average may get good value from the experience." Two wing leaders and one squadron medical officer emphasised the importance of a proper understanding and digestion of operational experience. The latter, who was invariably present at dispersal after a sweep, said that the experience of combat was so compressed that the pilots don't know until afterwards what has happened, till they have talked it out. He described three types of reaction: " the man who forgets his bad experience at once, the man who after he gets back does an intelligent retrospective analysis, and the man who ruminates." The last suffers strain. Both wing leaders who discussed the question insisted upon the importance when casualties have occurred of explaining to the pilots as soon as possible after they return from the sweep why these casualties happened and how they might have been avoided. For lack of such instruction one of them said: " many a bloke becomes windy almost from the start because his experiences are warped by reflection."

7. Discipline

For similar reasons, discipline was held to be of great value for ' discipline on the ground reflects itself in the air; if you can't keep them together on the ground you can't keep them together in the air.' ' Individualism is frowned upon and the pilot is only an individual while he is pressing his button. The individualists are soon missing.'

8. P.T. and games

Physical fitness was urged more strongly than in the heavy squadrons and the amount of indulgence was deplored. Eighteen officers were in favour of some form of regular exercise, and only four thought it unimportant. The majority were opposed to P.T. and to compulsory games, but felt that reasonable exercise, enjoyed by the man, increased his efficiency and alertness in the air.

9. Recreation

Recreation had a similar value but in particular the squadron release day, with adequate transport, was commended most strongly of all. Several emphasised the gain in recreational value if the day off was known beforehand. The main reason for this was that it enabled the man to plan ahead his occupation and company. Another reason advanced was that it enabled those who were so disposed to indulge in an alcoholic party without restraint. This was emphasised by two squadron commanders and one medical officer who believed in the value of an occasional party of this kind as a means of relaxation. One of them said: " A release day to be any good must be fixed beforehand. It enables a man to have a party the night before and know he won't be flying. The worst thing in the world is to be told you are going to have a day off and then have to go flying with a hang-over ". Another suggested that the release day should be from 1 p.m. to 1 p.m. " so that they can have a party and recover from it ". Of those who thought it important that the day off should be fixed beforehand, some commented on the difficulties of arranging this during phases of operational activity, for example : ' at present if we do a show and lose two aircraft, the fellow you have promised Wednesday off has it cancelled '. This squadron commander thought the chances of a recreational engagement being cancelled were such that few people bothered to make one. Others mentioned that the provision of a planned day off was dependent on an adequate reserve of pilots. One wing leader emphasised the need for squadron and flight commanders to have a regular day off on account of their additional duties and responsibilities, and observed that in fact these were the men who very often did not get it owing to their sense of devotion to duty, and in consequence felt the effects of stress earlier than others.

10. Leave

The nature of the operational duties was reflected also in a comment upon leave. More than seven days leave was considered by some to be too long, for it tended to let the man get out of practice and to lose his confidence. Short periods of leave, for example five days every four weeks, were thought to be more beneficial.

11. Problems of flying stress peculiar to night fighters

(*a*) *The signs.*—Loss of keenness may be evident in a tendency to over rate the badness of the weather as a reason for not going up or coming back early, and nervousness in the air may often be noticed by the controller over the radio.

(*b*) *Operational limit.*—There was general agreement that the limit in terms of operational hours was unsatisfactory since the amount of stress was so variable, and that there should be an over-riding limit in terms of months, for after a time most men find the unnatural existence of living by night trying, and need a change. Two squadron commanders independently suggested 12 months as the maximum for a continuous period of night flying.

(*c*) *Relief employment.*—Firm opinions were expressed on this subject by a station commander and a squadron commander. Each said that it was more of a strain teaching others to fly at night than flying at night operationally. Posting to a night fighter O.T.U. therefore was the reverse of a rest. Moreover, it failed to provide what the man chiefly needed, a change from the unnatural and monotonous state of living by night instead of day. It was suggested that there should be provision for interchange with other commands so that the period of relief employment should be spent on day flying. One station commander considered that the right kind of rest would be three months working on the land.

(*d*) *Operational conditions.*—The impression gained from 11 general duty officers who discussed the matter was that the risks from enemy action encountered by night fighters were relatively small. One squadron commander summarised the position thus : " The risks are negligible compared with other types of operational flying ; 10 per cent of the hazard is enemy action, 90 per cent the flying. Apart from the boredom of inactivity it's a thoroughly good job, interesting, exciting at times, and comparatively safe ". Eight mentioned *bad weather* as the night fighter's biggest enemy, and most important source of strain. Four emphasised the strain of *instrument flying* as an addition to the load in night fighters. It was stated that some men never became entirely confident in this, and that even an experienced man might occasionally have to contend with the conviction that his instruments were wrong, and the temptation to believe in his physical sensations. Nine mentioned *operational inactivity* as a serious load upon morale. At the time these officers were interviewed there had been very few opportunities for contact with enemy aircraft for many months. This meant 'endless practice with no action: lots of fully-trained crews with nothing doing'. They became bored with practices and one of the squadron commander's biggest worries was to keep them happy and occupied. One squadron commander remarked: "Anybody with experience who looked into my squadron could diagnose that they are suffering from operational inactivity now".

(*e*) *Sleep*.—Eleven discussed the problem of securing an adequate amount of sleep for night fighter crews. Three considered that there was no real difficulty if organisation were satisfactory and discipline enforced. If left to themselves crews were apt to get too little sleep as the result of delay in getting to bed, or getting up too early in order to go out of the camp. If after a night's flying they were forced to be in bed by a certain hour and told they were not allowed to go out until they had had their proper hours of sleep, they would have enough. The majority however thought that there was a real shortage of sleep which they ascribed to various causes. The most important was the inability of the average man to accustom himself to sleeping sometimes at night (when not on flying duty) sometimes by day. 'The uneven rhythm makes it impossible to switch over to day sleep. After two nights on you get a day or two off and return to the other habit of living.' 'If you were on night duty for three months you could get into a routine but with two nights on and two off you cannot get into step.' On stations containing only night fighter units the remedy suggested was a revised routine so that the working day for all flying personnel began regularly with breakfast at 13.00 hours. This would promote the habit of sleeping by day and would especially relieve the load for squadron and flight commanders who at present were often flying at night but had to be in their offices in the mornings.

Another practical difficulty was that of air crews who had gone to bed in the early hours of the morning having to break their rest in order to get breakfast. On one station this had been met by allowing them to have breakfast in bed. This was satisfactory for the officers who had batmen to bring it to them, but did not solve the problem for sergeants. On stations on which there were day flying as well as night flying squadrons the noise in the day time, especially the noise of aircraft, made sleep difficult under any circumstances. Facilities for sleeping at dispersal during the night when not on duty were described as unsatisfactory on the whole, owing to overcrowding and the disturbance caused by men coming in and going out at different times all through the night. The impression gained from the amount of attention devoted to the matter, and the effort made to secure improvement, was that lack of sleep for individuals who need full measure and cannot take their sleep in snatches is a factor of considerable importance in increasing the load for night fighters.

(*f*) *Intrinsic factor*.—In relation to the intrinsic factor of individual capacity three squadron commanders dwelt upon the recognition of specific incapacity for night flying. This might be due to several causes: fear of the dark in a man who had plenty of confidence by day; difficulty with instrument flying; or a low general standard of flying ability. Such incapacity whatever its cause was easily discerned by an experienced commander. It added greatly to the man's load. One squadron commander held that *aptitude for night flying* was so specialised that it should be recognised and the disposal of the unsuitable should be made easier than it is at present. Losses should be cut early and the man should be transferred at once to other duties.

(*g*) *Training and experience.*—The view was expressed that training and experience had a greater effect in reducing the load for the individual than in any other type of unit. The greater the number of hours of night flying a man had had the less strain he found it. For anyone with less than 200 hours of night flying the strain was considerable.

(*h*) *Physical fitness.*—The problem of maintaining physical fitness had its special difficulties for night fighters. It was mentioned that organised games in the afternoon tended to make a man tired and sleepy in the evening. Therefore, one station commander who considered physical fitness important had P.T. daily for all air crew before noon.

(*j*) *Success and recognition.*—*Lack of success* was specifically mentioned by several as being a greater load for night fighters than others, owing to the long periods without opportunity for contact with the enemy. Views generally held were thus expressed by one station commander: "They see a Hun and the effect is as good as a week's leave. If they go a long while without seeing any Huns they get very depressed."

Lack of recognition was also held by several observers to be a more important factor for night fighters than other units in affecting a man's ability to carry the load. It was stated that awards were few as compared with day fighters, and that the chance of earning a decoration by shooting down three enemy aircraft was small. Some form of recognition for continued good performance was therefore more necessary than in other units. It was represented that although the dangers for night fighters were less, the demand for a consistently high standard of flying was greater. One station commander considered that "it would be better if the D.F.C. were kept for gallantry in the face of the enemy and the A.F.C. was given for good stooging through the operational tour".

CHAPTER VI

PERSONAL INVESTIGATION OF PSYCHOLOGICAL DISORDER IN FLYING PERSONNEL OF COASTAL COMMAND

by

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Introduction

There was great similarity between the results of the enquiry into the incidence and causes of flying stress in Bomber and Coastal Commands, largely because so many of the duties were undertaken in the same types of aircraft. two or four-engined, with the same squadron organisation and similar conditions of station life. Observations of special importance or which refer to conditions peculiar to Coastal Command and which can readily be fitted into the framework of Chapter IV are described in this chapter.

1. The signs

The signs indicating the effects of stress were identical except that, because of the different nature of the duties, loss of efficiency was manifested in different ways.

Loss of efficiency.—The loss of keenness on the ground leads to deterioration in efficiency in the air. This may be apparent in a tendency to return early from patrol and to justify this action with complaints of petty mechanical failures, such as low oil pressure or minor engine troubles. The men use weather as an excuse, too. ' Often it is necessary to turn back from a trip, but men will begin to turn back because of the weather when it is really stuff they could get through. Sometimes before take-off they report the aircraft U/S without cause being found.' Loss of efficiency may be shown by failure to press home an attack, or by carelessness in flying technique. ' They go off without everything being on the top line, a bit over-confident thinking that nothing is going to happen.' This carelessness is particularly liable to occur at the end of a long patrol when it is accentuated by fatigue. A squadron commander said: " If you see an experienced man under or over-shooting you should find the cause." Another said that he approached a good pilot who was making bad landings on return, but who refused to admit tiredness, and insisted on going on only to write himself off a month later. An experienced medical officer of a general reconnaissance squadron said that in a time of great stress an excellent captain, whom he had noticed getting overtired, undershot and crashed. Another experienced crew just scraped home from patrol. The next trip they lost their way over Ireland owing to poor navigation, a very unusual thing for this crew. Shortly after, they flew into a hillside near the station. At the same time another captain, who had been piling up hours, made an astounding slip, giving the position of a convoy in clear.

Loss of efficiency, before it leads to an increase in accidents and errors, may be noticed by the controller, who may say that the flight reports are not so good. It may be reported that a boat is dirty and less well looked after, or Signals may report deterioration in efficiency. A commander of a flying boat base said: " It is pretty easy to detect any loss of efficiency in a crew. When I see a boat going off to time with unfailing regularity, the crew smart and the boat clean and tidy, I know they are all right." Occasionally the crew may report inefficiency in one member, saying, for instance, that a navigator is slow in his calculations, but except when this occurs it is not possible to pin it down to an individual, and it is merely evident that the efficiency of the whole crew is falling.

2. Facts noticed, but not reported, by the man himself

The similar conditions of duty were reflected in the introspective accounts of deterioration given by the commanders interrogated. A flight commander on boats gave this introspective account of his deterioration: "You must at the end of 1,000 hours find it very difficult to maintain the physical effort and mental concentration which is necessary to keep the job on the top line. For three months I found it increasingly difficult to work up the energy and enthusiasm to get around the boat, and I got to a point when I didn't check up on every little detail. I missed an error in navigation, which took no account of drift, and that was my undoing; it resulted in a pile up which would have been avoided if I had been efficient." The awareness of deterioration has individual differences—' One begins to mistrust one's own flying ability and becomes excessively cautious.' In another the ever-present realisation of fear becomes more apparent and he may become more apprehensive of such things as flying two-engined craft over the sea. Fourteen officers thought that the man himself is first aware of the changes in his attitude to operational flying, but there was agreement that the best men hesitate to admit it. Unfortunately, those who carry on without admitting their own deterioration are likely, through their increasing inefficiency, to have otherwise avoidable crashes.

3. Operational limit

The general principles underlying comment and constructive suggestion upon the operational limit has been presented in the Bomber Command report, but there was specific and forceful criticism of its measurement. In present conditions the limit chosen for particular duties was too long in some cases. For instance, a Cight Fommander of a Photographic Reconnaissance Unit (P.R.U.) flight said that he had never met anyone who had reached the limit. No one said that the existing limit was too short, but most of the remaining 42 observers considered the measure of the limit to be satisfactory for their particular duties. The *time* required to complete the hours of an operational tour greatly affects the difficulty in reaching the limit in some duties. One medical officer said: "it would take up to 18 months to do 1,000 hours in Catalinas and this station is so isolated that this should be taken into account." A Fight Commander in P.R.U. said that in 13 months he had just passed half his tour and it was the monotony which affected him rather than the nature of the operations.

Suggestions as to the form the limit should take in different duties were as follows :—

General reconnaissance :

Whitleys and Wellingtons.—Some officers thought that the present limit of 600 hours was reasonable, if it were used as a flexible guide, ' For some men, 300 hours may be a long time, but others can do 700 hours easily.' Others considered that it should be lower, one even suggesting 300 hours. Special features of duty which lowered the men's ability to reach a high limit are the very long trips they do, and the anxiety about engine failure over the sea.

Hudsons.—The tour must be carefully graduated to the duties. A maximum of 500 hours was considered satisfactory for general reconnaissance, while a limit of

200 hours for offensive strikes is far too high, since this represents 60 to 70 trips. A squadron commander said that at one time morale fell through this, since the squadron were losing on an average a crew a month, so that theoretically there was no chance of anyone surviving. One station commander pointed out that in Hudsons the duties are so variable, and the operational conditions in the same duty depend so much on the locality, that a generally applied limit is of little value.

Ansons.—There was no anxiety about the limit since confidence in the aircraft is so high and casualties have been low.

Boats.—A few officers considered 1,000 hours a reasonable limit, but the general opinion was that it was rather high. The objection to this long tour was not that exceptional stress was encountered, but that the time required to complete it led to staleness. There was a general recognition that some men could go to 2,000 hours without losing efficiency, but ' as the tour will take 18 months to do, it is much better to send them on a rest before they really need it.' One station commander thought a datum line at 750 hours would be best. Many said that the limit had to be modified to suit the duties, for instance, patrols in the Bay and in the Arctic or the Middle East were much more exacting than Atlantic convoy patrols, and so required a lower limit. All the officers of *Catalina* squadrons found that fatigue was greater than that found in the same length of time in Sunderlands.

In *Liberators* and *Fortresses* also the tour will depend on the location of the duties. As one squadron commander said : " 500 hours over the Atlantic is very different from 500 hours over the Channel ", but experience has not yet been gained upon the staying power of the average air crews in these aircraft.

Photographic Reconnaissance Unit.—The present limit was thought to be much too high in relation to casualty rates and enemy opposition. A flight commander said the old 300 hour limit should be restored, or better still, the limit should be assessed in sorties or months, since long periods of inactivity were encountered in the tour, particularly in winter.

3. The load : operational conditions

The special circumstances of operations in the command influence the nature of the load which has to be borne by the air crews. Strains, such as those imposed by the weather, flying over the sea and long trips and consequent fatigue are more exacting than in the other commands, while the acute factors such as the effects of enemy opposition, casualties and crashes are less evident.

(*a*) The *effect of bad weather* in causing anxiety and fatigue was emphasised by many of those questioned. The anxiety arises from doubt as to the weather conditions which will be encountered on return to base, especially if the landfall is difficult or the base is surrounded by hills. One station commander with exceptional operational experience said that the uncertainty of the weather at the end of a flight would play on a man's nerves for the whole trip. Others described the strain ' when you come back after your 12 hours, sometimes with little knowledge of what the weather will be, and little petrol. If you do find the weather down it is very tricky and this comes at the end of a trip when the pilot is tired.' It was observed that in Coastal Command one must fly under conditions of weather worse than those which obtain in other Commands, and that owing to the length of their trips they frequently have either to take off or land in the dark, thus adding to the strain. Some added that with modern navigational aids and expert flying control this source of strain was now less than in the past. The view generally expressed may be summed up in the words of a squadron commander who said: "Weather is our enemy. If everyone knew when he went out that the weather would be fine when he came back all would be well. It's the fear of the weather that gets people down in our job." It was also represented that bad weather greatly increased the fatigue of flying, and that it might sometimes cause strain of another kind when owing to bad weather conditions crews had to stand by for a long period before going off on a long trip. For Air Sea Rescue units bad weather greatly increased the difficulties of their job, and for

Photographic Reconnaissance Units unfavourable conditions might add to the strain either by disappointment at getting no results for a long trip or, if the weather were unsuitable for several days, leading to an accumulation of work with consequent fatigue.

(*b*) The strain of *long trips over the sea* was emphasised by many officers as contributing to the load in various ways. The *monotony* of it in itself was said to be an important source of fatigue. 'Miles and miles of flying over the water is very trying with nothing to look at, staring to look for something with no idea of where it will appear. The desire to take half an hour off is very strong.' Several squadron commanders considered this to be the most important single factor in the load for Coastal Command. It was mentioned that the effect might be cumulative, inducing a state of apathy towards the end of the operational tour. The commander of a boat flight said: "After you have done about 700 hours it is a great effort to maintain concentration and enthusiasm for 12 hours".

(*c*) *Fear of ditching owing to mechanical failure* was another source of strain frequently mentioned. This was intimately related to confidence in aircraft. The state of feeling commonly experienced was thus expressed by two squadron commanders, "Coming home from a trip you begin to look at your motors, and you are apt to sit a bit tight in your seat, knowing that if you do go into the drink there is not a chance of being picked up. Mechanical failure is a constant source of anxiety because of the danger of coming down in the drink. We have had one or two men cracking up because of this." Fear of similar disaster from navigational error was also mentioned. This was instanced by reluctance to use the heating apparatus in one type of aircraft for fear of compass deviation. It was said that towards the end of a long trip with little petrol to spare the anxiety about making a landfall might be a great strain, especially for the captain.

(*d*) Another source of strain mentioned was that of *flying for long distances over the sea at low altitudes*, especially at night or in bad weather. This added to the strain of flying as the automatic pilot could not be used, and to anxiety in case pressure changes might result in flying into the sea or into hilly islands. This was especially emphasised as an element of stress for torpedo bombers.

(*e*) *Length of trip* has already been discussed as a factor in the monotony of flying over the sea; it will also be referred to as a source of physical fatigue. It merits separate consideration as a cause of central nervous fatigue resulting from a combination of other factors with the prolonged exercise of highly skilled performance. Several officers questioned referred to a state occurring in the pilot at the end of a long trip in which there was falling off in efficiency characterised by an indifference to hazard, with loss of judgment and skill. This might not be appreciated by the individual at the time. There might be a tendency in this state for the pilot coming in to land through hills and in bad visibility to get his aircraft down somewhere and anyhow. This state was mentioned especially by officers of Boat squadrons in which the length of trips might exceed 20 hours, and in which the first pilot, in addition to his responsibility for aircraft and crew, might be flying the aircraft most of the time, and was invariably in control on landing (Loss of Efficiency, pages 69–75).

4. Physical factors

Almost all the officers interviewed mentioned *fatigue* as an important factor in the load. Many of them naturally tended to include the strain of anxiety. When this tendency was elicited and allowed for, there were over 40 (most of them general duty officers) who considered physical fatigue of some importance. We have included under this heading the strain of continued visual attention, as well as the effects of glare, noise, vibration, cramped quarters, hunger, lack of sleep, and the occupational fatigue of skilled performance (*Length of trip*, paras. (*b*), (*d*) and (*e*), p. 74).

Combinations of physical factors related to different types of aircraft and duties

There was most general agreement on the importance of fatigue in Boats, especially in *Catalinas.* The reasons given were : the length of trip which clearly adds to the weight of all other factors ; lack of sleep, which after about 16 hours begins to be important ; lack of a hot meal (it was stated that the addition of special equipment had made it difficult if not impossible to cook) ; cramped quarters, leading both to discomfort, and to bodily fatigue from getting about the aircraft in flying clothing ; noise ; glare. The strain was greatest for the captain because he had to do most of the flying, supervise the work of the whole crew, move about the aircraft a good deal, and take off and land the aircraft himself. An experienced squadron medical officer said that he had been told by good captains that the strain of the long trips was very great—"At the end of one, no one in the crew can be anywhere near the top line, and this is often the moment calling most for resource, initiative and judgment". He thought the repeated strain of these long trips had a cumulative effect.

In *Sunderlands* the ability to get two or three hot meals in the course of a long trip, and to move about the aircraft with comparative freedom, was said to offset fatigue to a considerable extent, though all the eight officers with experience of these aircraft considered that fatigue arising from the other factors was important.

Fatigue was also emphasised by the commander and medical officer of a *Hampden* Torpedo-Bomber squadron, the reasons given being that the pilot's seat is such that after four or five hours' flying it is difficult to find a comfortable position, there is no second pilot, and when flying at low altitudes the pilot cannot trust the automatic device for long enough even to stretch his legs.

Ten officers described fatigue in *Whitleys* as of some importance on trips of 9 or 10 hours. Cramped conditions were mentioned as contributory to this. It was generally held that a crew recovered from the fatigue of one of these trips after a day's rest, but that the number of trips which could be done in a week without cumulative effect was limited.

In *Wellingtons* fatigue was not considered to be important. ' There is a little fatigue at the end of the trip, but with a second pilot and George this is all right. They only do two trips a week, so it is quite easy.'

In *Hudsons* fatigue was described as still less important, the trips on the average being shorter and the aircraft more comfortable.

In *Liberators* and *Fortresses* more stress was laid upon fatigue on account of the length of the trips, together with the inability to cook a hot meal. This factor, as in the Catalinas, was considered to be of great importance. In the Liberator Mark I it was possible to carry a Clyde Cooker. A squadron commander said that in this type, having had a hot meal in the middle of the trip, he used to come back relatively fresh, whereas from a similar trip in the later types with nothing but sandwiches he would return feeling completely washed out. He thought that this state of fatigue had probably been the cause of several crashes. Both in the Liberator and the Fortress the addition of special equipment had resulted in cramped quarters, thus adding to fatigue.

Fatigue in *Beaufighters* was not considered of importance unless they were flying for relatively long periods at sea level when the occupational factor became evident. In all these types of aircraft and duties the strain of prolonged visual concentration upon the sea was considered to be an important source of fatigue. One squadron commander of a Boat squadron said : "After 16 hours you don't see anything at all. Everything becomes blurred, and you would miss a submarine or aircraft".

Visual strain was also described by officers of *Air-Sea Rescue* units.

In a *Metereological Flight* and a *Photographic Reconnaissance Unit* the only mention of fatigue was in relation to long P.R.U. trips in a Spitfire. These might last up to five hours. ' You sit strapped to the parachute and get cramped. You find yourself adopting all sorts of odd positions upon which you gave to ring the changes. You have to keep moving around, or else you lose your concentration.'

Eleven officers mentioned cold as a loading factor. It was held to be of minor importance except in certain types of aircraft, especially Catalinas and Liberators, when operating over northern waters. The main reason for this was lack of heating, either because the apparatus provided did not work, or because there were side effects (fumes, deviation of compass) which made aircrews unwilling to use it. The effect of low temperatures under such conditions was thus described by experienced captains of Catalinas. 'Under these conditions you get into a state in which you don't care, and the extra effort to get things done and to worry about getting back become impossible.' 'Sometimes one gets so cold one doesn't care what happens at all. It is the same feeling one gets with severe air sickness. It may come to a point when the crew as a whole don't care at all.' A similar state of apathy was stated sometimes to occur in Liberators. Three out of eight officers of Sunderland squadrons also mentioned cold as a stress factor, two of them criticising the efficiency of the heating apparatus.

5. Factors affecting the man's ability to carry the load

These were described in much the same way as in Bomber Command, but great emphasis was placed on leadership, and much thought had been given to this subject.

(a) Leadership

It was repeatedly stated that the most important factor in building up morale and so preventing the effects of stress was good leadership. Forty-two officers, 28 of them general duty officers, discussed this subject at length, and with obvious concern for its importance, with comment upon the place of the station, squadron and flight commanders in leading the aircrews. Concerning the *selection* of the potential leaders the opinions expressed fell into two groups. First there is the problem of selection from existing aircrew. It was said that no *commissions* should ever be given to aircrew until they had been tested in the squadron. There was the feeling that at present too many aircrew were being commissioned, irrespective of their ability to lead. In particular, instances such as that of air gunners arriving at a squadron with the rank of pilot officer were quoted. It was pointed out that the only practical difference between this man and his sergeant colleagues was that he lived in a different mess and wore a different uniform. A squadron commander said : 'In order to achieve and maintain proper leadership there must be proper selection of officers. Men should only be selected from aircrews for commissions on the basis of their power to lead and to administer. At present they are taken out because they are merely good members of the crew. There are not sufficient good leaders in the squadron to-day, and the reason is that people have been selected for their ability to fly." Another referring to the same subject in the same terms added : " At present there are plenty of pilot officers and flying officers but when the time comes they will be no good as squadron leaders ".

The second view had a similar basis, that men were commissioned because they were efficient members of air crew without consideration for their capacity to lead. The approach to the problem was different, however. It was pointed out that the granting of a commission had become a means of promotion of senior N.C.Os. rather than an appointment to a new form of duty. The view was held that the present ranks for air crews made this procedure inevitable, since only two grades of promotion existed for aircrew and therefore the granting of a commission had to be used as a routine step in the ladder of promotion. Six officers uniformly distributed throughout the command who mentioned this recommended that aircrew ranks should be lowered although the rates of pay should be unaffected. One experienced squadron commander suggested that while the living conditions, privileges and pay of aircrew should remain unchanged, their ranks should be Aircrew Second Class (A.C.2), First Class (A.C.1), Leading Aircrew (L.A.C.). The members of the crew who showed themselves suitable to be N.C.Os. by their personality and example should be promoted sergeants, to lead aircrews in their full capacity as N.C.Os. Promotion to flight sergeant and warrant Officer would then occur, and from the N.C.Os. the men who stood out by virtue of their personality, education, mode of living and excellence of performance should be selected to be the leaders. In this way the officer would invariably be capable of leadership, and a proper standard of flight and squadron commanders would be maintained.

The discussion upon the method of selection led to views upon the *type of leader*. It was repeatedly emphasised that flying ability and qualities of leadership were not necessarily associated, although everyone said that flight and squadron commanders should have had operational experience, should fly on operations occasionally, and should take an active and vital interest in operational flying. 'Morale was low until a new C.O. came who was always there, if he was not flying himself, to see the crews off or returning. He nursed along the timid, flew with the shaky crews himself, chose the shaky-dos and sent the squadron morale right up'. A station commander said: "The commander must have his whole interest in the squadron both on the ground and in the air". Some said that it was unimportant that the squadron leader should be the best pilot—what the squadron liked was just to see that he was willing and able to share their risks and hardships.

The qualities most to be desired in a leader were variously portrayed, but several officers said that the best results seemed to be obtained by those who, though mixing freely with the air crews and knowing them intimately, could still maintain discipline and, when occasion demanded, be firm and impersonal. It was the experience of some that the more quiet and restrained leaders commanded greater respect than others. They thought it simple to recognise the potential leader, although his personality could not be forecast. The successful commander was found to mix freely with the crews and to join in parties in the officers' and N.C.Os'. messes, relaxing any show of discipline or authority. He did this in order to observe the crews and to know them personally. He should mix with them equally in their occupation on the ground, in training, in games and in recreation. This personal interest in the crews was an essential prerequisite of good leadership in the squadron. Squadron and flight commanders who lived in close personal touch with the squadron were repaid by the efficiency and high morale in the squadron. This personal method of leadership was often made difficult by the inaccessibility of the N.C.Os. in their mess; the number of air crews in squadrons of heavy aircraft; the rapid turnover of crews; and repeated movements of squadrons with posting of senior officers. The method was seen in operation in ideal circumstances in small squadrons of the Fleet Air Arm, whose personnel had been unchanged for many months. Using the naval divisional system the squadron commanders had the intimate confidence of all their crews. The result was that, in spite of strict discipline, signs of deterioration were easily recognised, and stress was reduced to a minimum. This gave weight to the observation that in large squadrons the flight commanders are in a better position to influence their men by good leadership than is the squadron commander.

One successful commander had a captain's conference each week, which he himself did not attend, presided over by the flight commanders. Here difficulties were discussed and advice sought. Within two hours the flight commanders and their seconds in command met the squadron commander and thrashed out all the difficulties. Solutions were discovered, and applied 'so that the crews are constantly aware that their leaders have their welfare at heart and that they are being considered'.

The *education* of leaders was discussed. Those who raised this subject agreed that the quality of leadership is inherent in the man, and at best can only be guided. Reference was made to a command letter issued in September, 1942, which provides for such education in newly commissioned officers. There were suggestions that the more senior officers when becoming flight commanders should be guided in leadership and administration, with advice upon the handling of men and on the most effective way of increasing their efficiency and helping them through their tour.

The very important part played by the captain, especially in large aircraft and boats, was a frequent subject of discussion. " The captain's job in these large aircraft is very responsible and is a trying one. When the men are well disciplined on the ground it makes things much easier for the captain", said one squadron commander. Talking of this a squadron commander said: " The captain has a lot to do with it. A good captain means a clean boat and a tidy crew, and if you see a scruffy crew you know that the boat is wrong." The responsibility of the captain is great and consequently he is especially liable to fatigue. He requires a special training, and his selection is as important as that of the other leaders already discussed. The importance of having a captain of senior rank was mentioned by several. They thought that every effort should be made to prevent a sergeant captaining a craft with a commissioned officer in the crew. As it is the convention to make the pilot captain it sometimes happened that, as has been described above, a good pilot without the gift of leadership was in practice superseded by another member of the crew, often the navigator. This unofficial delegation of powers was unfortunate and resulted from faulty selection.

(b) Success and recognition of effort

The peculiar nature of duties in Coastal Command, involving as they do monotonous reconnaissance with infrequent and uncertain reward led to much comment upon the effect of success and recognition of effort in counteracting the effects of stress.

(c) Success

The place of *success* and its recognition in maintaining morale was discussed by 70 officers. That success has a high morale value was indicated by many, and instances were given of the uplift caused throughout the whole squadron by successful attacks on U-boats, shipping and enemy aircraft. The success of an Air-Sea Rescue squadron in saving life and of a Photographic Reconnaissance Unit flight in obtaining excellent photographs were all mentioned.

Lack of success was thought by the majority to have a very demoralising effect, and such expressions as 'Anti-submarine patrol in our area where you never see any is killing for morale,' and 'If they don't get an occasional success some of them loose the aggressive spirit and are contented just to stooge' were typical. Four said that the crews did not mind failing to achieve material success, but this was offset by the observation that there was a tendency in the command to rationalise upon this topic. It was observed that lack of success had the same effect as inactivity and that they usually ran together. (*Inactivity*, pp. 46–47).

Ten officers referred to the *lack of offensive success* in their particular duties. These observations were particularly apt in night bombing squadrons engaged upon anti-submarine patrol. A squadron leader said: " In night bombing there was a definite objective and a prospect of success which inspired high morale. As soon as the aircraft landed the ground crews would come out to see if the bombs had been dropped, as they usually had, and wanted to know all about the trip. Now they don't bother as they know the depth charges they've loaded will still be there. They used to be keen to paint a new bomb on the aircraft as soon as possible for each sortie done, but soon gave it up, for there was nothing to make them enthusiastic."

A commander of a Beaufighter Reconnaissance Squadron said: "Their present job has a very low morale value. It is tip and run along the coast looking for shipping and taking a photo. There is no chance of being offensive and they have no concrete success." He had asked permission to strafe aerodromes on the Dutch coast in order to raise morale. Another said: "Here they get fed up seeing only our own ships and getting no positive results"; and another: "They want to bomb something and like material success. It is very demoralising just looking for shipping and coming back with the news." Success has its greatest value when it means fully completing the specific job in hand.

Constructive suggestions were put forward to counteract the demoralising effect of this apparent lack of concrete results in really important duties.

The first was *explanation* of the purpose of their duties. On anti-submarine patrols by day, results had been poor, and morale was low. When the crews were told that they were keeping U-boats submerged by day to be the targets for night patrols they knew what they were stooging for, and morale rose. Again, a wing commander said that he had heard confidentially that there had been no sinkings in the area of their patrols for weeks. He thought that had the crews been told this, they would not have resented the monotony and lack of material success.

The *demonstration of success* in photographic reconnaissance by showing the flight their photographs on the same day created a competitive spirit and a sense of professional pride. In Air-Sea Rescue, squadrons making contact with the crews rescued had an enormously valuable effect. One squadron commander made every effort to trace the rescued crews and to invite them to the station to meet the squadron. This often took weeks, and sometimes they had forgotten the event by the time a party was arranged. He urged that as so many searches were fruitless, groups should notify the squadron of the identity of rescued crews without delay, so that squadron records of the success could be kept, and the squadron see how worth while was their work. It was thought that when life-boats were fitted to Hudsons the morale effect of a rescue would be enormous.* The reaction of many was summed up in a wing commander's remark: "We don't get that personal satisfaction out of the job that others have and that in itself over a period of time gets people down. There are so many hours of flying in which we see nothing, that the crews tend to get apathetic." Another said that he always tried to give a new crew the chance of an early success. He picks out a ship in a poorly defended area for them because "Once a crew has pulled something off they have confidence and are all set for the tour, but when they go out many times and see nothing they are likely to throw in their hands."

(d) Praise

Praise is most important. Recognition of conscientious effort and of hard-won success by a telegram from Command or Group has an enormous effect upon the squadron, which was exemplified by eight officers who felt that this recognition by higher authorities would not lose in value by more frequent application. The practice of going to Command or Group to report the sinking

* This was later found to be the case.

of a submarine was also warmly recommended. The most valuable praise of all was, however, the quiet praise of the commanding officer. A very experienced squadron commander said: "Air crews are not deeply interested in the moral issues of the war. They are simple souls and must have someone to work for. If they leave the ops. room saying to themselves 'I did a good job and the C.O. is pleased' they have achieved all they want."

(e) Decorations

There was general agreement on the very high morale value of decorations. This is nearly as great to the other members of the squadron as it is to the recipient himself. It follows that to have their full effect, awards should be made while the man is still in the squadron, so that they may all participate in the honour and celebrate it together, for an award which is made when the man has gone to the O.T.U. helps the squadron spirit very little. Several officers consequently said that *immediate awards* are the most valuable. A station commander summed up the views of others by saying: "Adequate decoration is the greatest factor in maintaining morale, but the decoration should be given while the man is in the squadron, for this has a huge effect on the rest. They all have a party and they all wonder who will get the next. Immediate awards are the most worth while of the lot."

Twenty-two officers, all senior and many decorated, urged *widespread distribution of decorations* in the Command. They said that they were aware that within the allotment, decorations were fairly given, and that the hazards of their job were often not as great as in Bomber and Fighter Commands, but argued that if the value of their work obtained recognition men would be all the better able to stand up to their load. One wing commander said: "The lack of decorations supports the popular view, which has even got into the Service, that Coastal Command is just an unimportant stooge job compared with Fighter and Bomber." As so few decorations were available for distribution those in duties which called for prolonged high performance with little material success, such as General Reconnaissance, Photographic Reconnaissance Unit and Air-Sea Rescue were particularly likely to receive too meagre recognition.

This argument led to the view that as spectacular success is rare and some times fortuitous by the very nature of the duties, decorations should be made more often for duty efficiently performed without evidence of offensive success. This view led to the suggestion of the award of a *tour ribbon.* Seven officers said that if a man had completed his full tour efficiently and well, his flying had been distinguished, and even if he had not been as fortunate as some in, say, destroying U-boats, he should be awarded the D.F.C. A commander of a General Reconnaissance squadron said: "it is very difficult to find any one thing on which to recommend a man and you don't get recognition for just plain stooging, so that a high proportion of people end a tour unrecognised. They should be given the D.F.C."; and a Station Commander: "Anyone who has done a good tour and been shot up once or twice by flak boats deserves the D.F.C." Eight officers said that the D.F.C. should be preserved for immediate awards, in recognition of great success or great gallantry, but that *another ribbon should be given for distinguished operational flying.* A wing commander said: "The standard of decorations was invented for the last war and not for the changed conditions of this war. There should be a D.F.C. and D.F.M. for every member of a crew that gets a U-boat, or at the end of a good tour they should be decorated." Another that: "They really should have something to show when they go to an O.T.U., but this shouldn't be the D.F.C. which should be kept for special occasions. A tour ribbon would be best." Some of these officers suggested a star for succeeding tours as well as a distinctive ribbon, and some remarked on the difficulty of giving recognition to members of the crew other than the captain. Two suggested a crew medal, and two mentioned the uplift given by the crew being mentioned in dispatches when the captain is decorated. Whatever suggestions they made, these officers were unanimous about the positive value of the hope of decoration because "when we get no positive results we have nothing with which to bolster up morale in a rather tedious job."

CHAPTER VII

INVESTIGATION OF PSYCHOLOGICAL DISORDERS IN FLYING PERSONNEL BY UNIT MEDICAL OFFICERS

by

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Introduction

Many of the reports upon psychological disorder in flying personnel which have been submitted by us, have presented the subject as it is seen by the neuro-psychiatric specialist. This has necessarily been true of all the reports based upon the system of case cards returned by these specialists. Although the information obtained from such a source has many obvious advantages over that which might be obtained from other medical officers, it has the disadvantage of being second-hand. The men seen by the neuro-psychiatrist have all been referred by the station medical officer, who has selected them from a large number. Others he may have handled himself, or marked for executive disposal without asking for specialist advice. In all cases, whether ultimately referred to the specialist or not, there is information available to the unit medical officer, who has watched the man's progress through his flying career, has observed his reactions to stress and has obtained verbal assessments of stress and reaction from commanding officers with whom he is in daily contact—intimate, personal knowledge of the case which the specialist lacks. This gap in our knowledge, recognised when we began investigations, we have tried to fill by carrying our enquiries to unit commanders and medical officers in the operational commands (Chapters IV, V and VI). The present investigation represents an attempt to obtain an account of psychological disorder in flying personnel as seen and described by unit medical officers themselves, including all cases dealt with by them, whether referred to a neuro-psychiatrist or not. The attempt has not been altogether successful, for there is reason to believe that we have not obtained a complete sample of the material, but enough has been accumulated to furnish an idea of how the problems of lack of confidence and neurosis in air crew are handled by unit medical officers of the Royal Air Force.

1. Method

The method adopted in compiling this report was to obtain from the unit medical officer a simple case return of a stereotyped kind for all members of air crew seen by him ' for complaints which have no physical basis, or who having no physical disability, state that they feel unable to carry on with flying duties '. The card gave details of the patient's Service particulars and his flying experience, with short accounts of the main symptoms of the illness, its main causes, the treatment and disposal advised, and the prognosis. Diagnosis was limited to a choice of five headings : anxiety, depression, fatigue syndrome, hysteria and loss of confidence. The instructions to medical officers with a specimen card are reproduced on pages 97–98. An adequate number of cards, with instructions, was forwarded to every unit medical officer in Bomber, Coastal and Flying Training Commands, to Air Defence of Great Britain and 2nd Tactical Air Force. Squadrons operating from the

United Kingdom and Western Europe were consequently included, and all flying training units in the United Kingdom. Senior Medical Officers of Groups were responsible through the command, for ensuring a card return for every case arising during the 20 weeks beginning 15th May, 1941.

2. Material

The number of cases reported was considerably less than previous calculation had led us to expect, and records were received from a comparatively small number of the medical officers concerned. We believe, therefore, that our material represents the contribution of those medical officers who were most interested in the investigation rather than a fair sample of all cases.

3. Characteristics of the 286 cases reported

		Cases
Air crew category	Pilot	83
	Air Gunner	74
	Navigator	41
	Wireless Operator	39
	Flight Engineer	29
	Others	20

Exactly a third were commissioned.

Duties	Night bombing	117
	Under training	87
	Instructing	19
	Coastal General Reconnaissance	18
	Night fighter	10
	Troop glider	10
	Coastal boats	6
	Day bomber	5
	Day fighter	4
	Other five operational duties	10

It is interesting that night bombing contributed 65 per cent of all the cases from operational units.

		Cases
Age	Under 20	28
	21–25	126
	26–30	66
	Over 30	66
Total hours flying experience	1– 100	43
	101– 200	58
	201– 500	118
	501–1,000	36
	More than 1,000	31

About two-thirds had over 200 flying hours to their credit.

		Cases
Operational flying	No operational flying	110
	Under 100 operational hours	98
	Over 100 operational hours	78

Just over 60 per cent had had operational experience.

Although no great reliability is claimed for this group of cases as a sample of all neurosis occurring in air crews, comparison of the characteristics given above with those for all cases reaching the neuro-psychiatrists in 1943–1944 (Chapter XI) shows that there is no great dissimilarity between the two groups.

4. Symptoms of flying stress

The early stage of symptoms resulting from flying stress has been considered in reports, but the independent records of medical officers of individual cases provide a clinical picture which is full of significant detail, and when viewed as a whole gives a clear and lively impression. This might be conveyed to others by reproducing the observations recorded under " Symptoms " on all the cards, but even this would be inadequate, for symptoms can only be properly appreciated in their full setting or cause and circumstance. It is impracticable to append to this report all the data required for the complete picture. We propose, however, in this and in other sections to present many illustrative case records, in which the most relevant features will be described in the medical officer's own words. In each case an outline of the whole story will be provided as a background to the special feature to be discussed. Thus in the present section which is chiefly concerned with symptoms, the case records quoted will also contain observations upon aetiology, treatment and prognosis, which will be referred to later under the appropriate headings.

The symptoms described might be classified as *mainly psychological or mainly physical*, severe or slight, acute or chronic, and in several other ways. Arbitrary classifications of this kind, however, make partitions which are too inelastic to contain the facts of clinical observation. Therefore, no systematic classification of symptoms will be attempted, though the distinctions mentioned above will appear in some of the cases quoted.

> Case 43 : A Flying Officer, air gunner, aged 33, was seen at an O.T.U. where he was instructing, but just due for a second operational tour in heavy bombers. He complained of insomnia, loss of appetite, nervousness, a feeling of dread, and of the possibility of letting his crew down if called upon to fly on operations again. It was noted that he was irritable with air crew and other familiars. The medical officer discovered that his first tour (26 sorties) had been quiet, judged by ordinary standards, but after 17 trips tenseness became extreme, though he finished the tour. He was not disturbed by non-operational flying. The case was discussed with the Chief Instructor, and it was decided that he should continue his job as a Gunnery Instructor for the time being, the ultimate prospect of returning to operations being regarded as fair.

The symptoms in this case arose from the cumulative stress of a normal operational tour and were reactivated by the prospect of a second.

> Case 135 : A Sergeant, air gunner, aged 20, was seen on an operational station, where he had completed 12 sorties on heavy bombers, complaining of waking up at night in a cold sweat, having bouts of uncontrollable quivering, and dreaming every night about crashes, which always involved his own crew but never himself. These symptoms began after a sortie to Brunswick on which the starboard inner motor was shot away and the port inner feathered. The aircraft was attacked five times on this trip and one of the crew wounded. Shortly after this, while he was away, the rest of the crew went missing. He was engaged to be married. He was treated on the station before reference to a neuro-psychiatrist, with a poor prognosis.

The combination of symptoms presented in this case is repeated in many of the records, usually associated with some outstanding episode of stress as in this instance, but sometimes as a reaction to flying generally as in the following case. —

> Case 49 : A Sergeant, air gunner, aged 30, was seen at an O.T.U., with a total of 13 hours' flying, complaining of sleeplessness, lack of appetite and nightmares concerning aircraft. ' He wakes up in the night in a hot or cold sweat. When in the air he loses his grip on himself, gets flustered and panicky and seems to do everything wrong.' The symptoms had begun when he started flying He had had nightmares as a child

and had always been a bad sleeper. He was anxious about his wife, who had pulmonary tuberculosis. The medical officer gave him a bad prognosis and he was disposed of by the executive.

This case is representative of a group in which temperamental unsuitability for flying reveals itself by anxiety symptoms early in training.

Case 18 : A Sergeant, flight engineer, who had completed 20 sorties on heavy bombers without any special stress, complained that ' he feels very tired most of the time, especially after flying. Sleep does not revive him. He has headaches and his eyes feel sore after reading.' His symptoms had been present 14 days, the last 9 of which had been spent on privilege leave without improvement. The medical officer found no neurotic predisposition, arranged for him to have 10 days ground duties, during which he saw him several times and gave him medicines, and observed in an after note ' he finished his tour quite fresh.'

The symptoms in this case are typical of a small group in which tiredness is the leading complaint.

Case 131 : A Flying Officer, pilot, aged 26, was seen at the beginning of a tour of nightfighter Mosquitos. ' He complained of periodic spells of insomnia with nightmares, and dread of flying particularly in poor weather, especially icing—is preoccupied with the thought of the things that might go wrong.' His symptoms were of 2½ years' duration dating from an occasion during his first operational tour in Hampden night bombers, when he had to ditch due to icing and was in the sea (January) for 18 hours. He was off flying for a month and then completed his tour despite symptoms. Subsequently he instructed at an O.T.U. for eighteen months. Three of his near relatives had had psychological illness and he himself was introspective. Re-assurance and explanation from his medical officer did not help him and he refused sedatives. He was therefore referred to a neuro-psychiatrist with a bad prognosis for further operational flying.

This case is an example of long standing symptoms in a predisposed individual of good morale, symptoms which only became disabling when he returned to operations after a very long break.

Case 36 : A Sergeant, flight engineer, aged 36, was seen on a heavy bomber operational station when he had completed 1 sortie. He did not consult the medical officer, but was examined routinely when he stated that he was unwilling to continue flying. ' He lacks confidence in his own ability to carry out duties as an air crew member, is depressed, worries over trifles, and sleeps badly. He has decided that he will not make the grade and wishes to discontinue flying.' He had one crash landing at his H.C.U. The medical officer found that he had always been a chronic worrier and thought him temperamentally unsuited for air crew duties. He was disposed of by the executive.

In this case the symptoms were slight, the decision to withdraw firm.

Case 26 : A Sergeant, navigator, aged 32, with no operational experience, was seen at a heavy bomber O.T.U. complaining that " he has been worried and unable to think clearly all day. He could not sleep after last night's flying is pale and tense and asks to be taken off flying for the night." On the previous night his aircraft had nearly crashed, overshooting three times owing to unserviceable flaps. Six weeks previously he had been in a creash landing and was trapped in the fuselage. Five months previously he had been in a forced landing with an engine on fire. The medical officer found no neurotic predisposition, took him into Sick Quarters, administered 3 grains of nembutal, and gave him an encouraging talk next morning. He returned to full flying duties and finished his course. The medical officer remarked under prognosis ' average type, chief trouble is lack of confidence in pilot. Will probably experience some difficulty in completing operations.'

The symptoms in this case were acute but mild and were relieved by prompt and efficient treatment.

Case 38 : A Sergeant, navigator, aged 26, with no operational experience, was seen at a heavy bomber O.T.U. complaining of headache while plotting. ' He asks to come off flying for this reason, as he feels he cannot take responsibility for the safety of the crew unless the headaches can be cured.' He had had no stress. The medical officer considered him slightly predisposed to neurosis owing to timidity. Previous correction of a minor refractive error had failed to relieve headache. It was noted that he had started training as a pilot but failed to make grade for *defective vision*, which was really a neurotic symptom. He was referred to a neuro-psychiatrist and boarded permanently unfit for flying duties. The medical officer considered that he should have been weeded out before.

This case is representative of a group in which physical symptoms are presented with little anxiety.

Case 265: A Sergeant, air-gunner, aged 35, who had completed 20 sorties on heavy bombers, presented at his operational station with anxiety and tremors, tired eyes and backache. The medical officer observed "He has been drinking overmuch. No particular stress. The crew do not wish to have him any longer. His mother had a nervous breakdown. He has always been emotional and temperamental and afraid of heights." He was referred at once to a neuro-psychiatrist, with a poor prognosis.

In this case it was probably not so much the nature of the man's symptoms as his crew's reluctance to have him which influenced the medical officer's disposal.

Case 275 : A Warrant Officer, pilot, with a total of 19 operational sorties on Bostons and night-intruding Mosquitos, was seen on an operational station complaining of evening headaches and a feeling of uneasiness and tension. 'Says he feels jittery and lacks confidence in night flying following a crash. He had similar symptoms after a crash in India two years ago, when he injured his leg and was in hospital three months. Was O.K. on Bostons but not confident on Mosquitos, but was persevering and then had a night crash after four hours' flying. After this he had to hang about waiting for an executive decision whether he was fit to fly or not. The suspense affected him. He is rather a worrying type but quite keen. His confidence has been restored by explanation of his symptoms and he is keen to get back on Bostons. He is to be returned to a Boston Squadron and I think will cope satisfactorily. The Mosquito was master of him rather than he master of the Mosquito. He had completed 16 successful operations on Bostons before transferring to Mosquitos.'

This case illustrates the interpretation of symptoms and their management by a very experienced station medical officer.

2. Diagnosis

The cases were divided among the five available diagnoses as follows :—

Diagnosis	*Cases*
Anxiety	147
Lacks confidence	97
Hysteria	28
Fatigue syndrome	26
Depression	14

It will be observed that 78 per cent of the diagnoses were either anxiety state or lack of confidence. Both these terms imply a state of fear, almost invariably arising from and related to flying duties. One distinction between the two in the minds of medical officers appears to be that between fear which is beyond volitional control and that which is not. The former is characterised as morbid and recognised as a medical disability, the latter is regarded as no more than the mental distress endured by fit men. A second distinction is that provided by the presence or absence, in association with fear, of mental or bodily symptoms such as depression, tension, restlessness, irritability, compulsive feelings, phobias, insomnia, nightmares, tremor, sweating and so on. Whether a medical officer made the diagnosis *lack of confidence* or *anxiety state* seems to have depended upon the relative importance given to these two distinguishing features. It is evident that in the minds of most medical officers the important question is not whether the man has symptoms apart from fear, but whether his fear or other symptoms are beyond his control.

Among the 97 cases labelled *lack of confidence*, there are very few in which no symptoms of any kind were recorded. The following cases illustrate this small group.

Case 60 : A Sergeant, air gunner, aged 31, with 100 hours flying, was seen by the medical officer at a Heavy Conversion Unit. ' He asks to come off flying, as he states that his wife would leave him if he does not. No worries. No nervous symptoms associated with flying. No crashes. No flying stress. No evidence of nervous predisposition. A long talk with the object of getting him to change his mind has had no result.' The commanding officer was informed and the case dealt with by the executive. The medical officer's comment was as follows : ' If keen to fly would do so despite his wife's threat. He must realise that she would not leave him if he told her that his duty was to continue.'

Case 246 : A Sergeant, flight engineer, aged 24, with 30 hours operational flying on heavy bombers, refused to fly after briefing for a long trip to Germany following several easier targets. ' He never claimed any sort of illness and admitted there was nothing wrong with him.' He had home worries, his wife being ill. There was no evidence of any abnormal instability or excessive timidity. ' He is rather the self-assured type now, although worked up at the time of his refusal to fly.' He was dealt with by the executive.

In other cases the diagnosis of lack of confidence was apparently made because of the absence of any other symptoms except those of fear, though the fear was considered beyond the man's control. The following case is an example :—

Case 225 : A Sergeant, air gunner, aged 27, 120 hours, no operations, reported to the medical officer at a Heavy Conversion Unit, having experienced an acute fear reaction while flying. A Halifax went out of control, the patient had to abandon aircraft but at first could not open the turret. He was very afraid. He did not fly for a week ; when he did so he again experienced acute fear in the air. No neurotic predisposition was discovered. The medical officer instituted the following treatment. He explained the mechanism of fear and told the patient that it was natural and universal. He admitted him to Station Sick Quarters and gave him nembutal. He flew with him and encouraged him while in the air. He then used suggestion on the ground and got him crewed up again. At this point a further crash on the station occurred. The patient set out on a cross-country flight but had such acute symptoms of fear, sweating, trembling and irrationally wanting to abandon aircraft, that the trip was abandoned after 10 minutes. The medical officer's comment was " A good type who has made every effort to get over it. He might have been O.K. if he had flown sooner after the incident, but I doubt if he could make much of ops. if crashes are going to shake him like this every time." He was consequently referred for executive disposal without reference to a psychiatrist.

It is of interest that 21 of the 97 cases with lack of confidence were also given another diagnosis, usually anxiety state. An example is Case 195 :—

Case 195 : A Sergeant, navigator, aged 24, 250 hours, 10-day bombing sorties in Mosquitos. His pilot was forced to abandon four sorties because the patient said he felt ill and unable to carry on. On one occasion at his O.T.U. when lost in cloud the same thing occurred. His symptoms ' varied from trembling and vomiting to semi-collapse. He says that everything goes hazy but that the symptoms vary each time.' The only stress he had experienced was on one trip in which an engine cut out over enemy territory. The pilot had no difficulty in bringing the aircraft back home. No neurotic predisposition was discovered. The M.O. saw the patient each time and gave him luminal before his trips. He encouraged him and remarks that he had " given him four chances." He then considered it unwise to persevere any further with the patient, and referred him to the executive for disposal as a case of lack of confidence.

There is no indication in this case of the reason for disposing of the case as lack of confidence, but it may be supposed that the medical officer thought that his symptoms were not severe enough to be disabling and could have been endured with an effort of will. The case might well, however, have been disposed of as an anxiety state by a medical officer with different views and illustrates the difficulty in making the distinction between lack of confidence and neurosis.

It is shown by Bradford Hill and Williams (Chapter XXII) that whereas there was generally fairly close agreement between two independent psychiatrists in making a diagnosis of anxiety state or hysteria in flying personnel, there was only an even chance of agreeing upon the diagnosis *lack of confidence*, the alternative diagnosis being almost invariably anxiety state. In the present series of cases the same difficulty is evident, but the tendency of the medical officer as compared with the neuro-psychiatrist is to attach less importance to the symptom pattern and more importance to the criterion of volitional control. This may well be because the unit medical officer knows that many men endure fear with associated symptoms of what the psychiatrist would probably call an anxiety state, without disability. The tendency of the unit medical officer, therefore, when confronted with a state of fear, whether associated with other symptoms or not, is to ask himself whether these symptoms may not be overcome. It is only when the case fails to respond to treatment that he is prepared to regard the man either as suffering from a medical disability in the form of an anxiety neurosis, or as having failed to try his best. Among the cases kept at full flying by the unit medical officer are some men who might have been regarded by the psychiatrist as at least temporarily unfit owing to an anxiety state. One of us from his past experience as an infantry medical officer has been long convinced that the dividing line between anxiety neurosis and normal fear in combatants is artificial and related to circumstance. The same view has been expressed by Spiegel (1944) writing of his experiences as an infantry battalion medical officer in the Tunisian campaign. " It soon became apparent ", he says, " that a tense, tremulous soldier was not necessarily a psychiatric casualty. He was if we made him one and sent him back, but often he was *not* a casualty simply because he was *not permitted* to be one. (author's italics.) A state of tension and anxiety is so common in the front lines that it must be regarded as a normal reaction in this grossly abnormal situation. Where ordinary physiological signs of fear end, and where signs of a clinical syndrome begin, is often difficult to decide. This is an important consideration because not only was some of the gallant and heroic work done by men and officers in acute anxiety states, but a considerable amount of the ordinary combat accomplishment was performed by ordinary men experiencing rather severe anxiety." This statement is the more interesting because it is made by a trained psychiatrist. Circumstances for air crews are of course very different from those of the soldier. Exposure to danger is occasional and intermittent, opportunity for reporting sick between operations is easy and there is always the consideration of which doctor and patient are both aware, that even a mild anxiety state may make a man unfit for air crew duties. The medical officer cannot press men so hard in the air as on the ground. Nevertheless one fifth of the cases reported in this series were kept at their duties despite their fear or anxiety state. The following case is a characteristic example.

> Case 218 : A Flying Officer, navigator, aged 24, 300 hours, 17 night bombing sorties in Lancasters. Since his third operational sortie the patient had reported to the unit medical officer on several occasions. At his first visit he admitted lack of confidence for flying and fear that he would let the crew down. Several times after that he reported to station Sick Quarters with minor complaints ' rather unnecessarily.' He also complained of slight air-sickness. His operational tour had been uneventful. The medical officer found him "a sensitive individual who has calculated the odds against survival. He is facing up to the task by forcing himself to carry on." He was persistently reassured about his ability to succeed and the medical officer enlisted the help of the navigation officer, who used to congratulate the patient on his good performances. A frank discussion of fear helped the patient, and the medical officer commented: " With persistent encouragement I feel confident he will complete his tour of duty." The patient continued to operate and the medical officer's last note was " he will complete his tour with encouragement, although if he sustains any great stress I fear he will break down." The patient and his crew subsequently failed to return from an operation, but the medical officer had sustained him through at least 14 sorties.

Physical symptoms associated with an anxiety or fear state were usually accepted as a part of this syndrome, the diagnosis of hysteria being reserved for cases in which symptoms were produced or maintained by obvious motivation. The diagnosis of *hysteria* was recorded in only 10 per cent of the cases. In several cases in which the record suggests that this diagnosis might have been made the medical officer seems to have concluded that motivation was too near the conscious level to warrant any label other than lack of confidence. The following is a characteristic example :—

Case 134 : A Flight Sergeant, navigator, aged 26, who had completed five sorties on Boston day-bombers without any special stress, had the following record : 'For several weeks has complained of poor vision and suggested that he was incapable of doing his job. The ophthalmic specialist finds him fit for full flying duties. He states that his mother and only surviving brother are invalids. He was reassured in several interviews, but after vainly trying to get taken off flying on account of poor eyesight, put in a written request to the C.O. to be taken off on account of family troubles.' The case was dealt with by the executive.

Comparing this case with others we must conclude that the distinction between lack of confidence and hysteria is as difficult for the medical officer as that between lack of confidence and anxiety, and is arrived at by practical rather than academic considerations. If the man who presents physical symptoms as an excuse for evading flying duties is ready to abandon them with reassurance he is given the more respectable diagnosis of a neurosis. The following case for example was diagnosed hysteria :—

Case 12 : A Sergeant, air gunner, aged 23, 252 hours, had done 240 operational hours on anti-submarine patrols from Newfoundland on Hudsons without any exceptional experiences. This operational flying was said to have been 'unofficial' owing to shortage of crews. He was now under training at an O.T.U. for heavy bombers. He reported sick with noise in the right ear for two months following a mild otitis media, and a story of vomiting after most of his meals for the past fortnight. The medical officer found no abnormalities, but discovered that he recently had learned that his wife, with whom he had had only a few weeks' married life, had left him for another man. He found no evidence of neurotic predisposition, but suspended him from flying, pending the report of an aural surgeon, who found no disability. With reassurance he returned to full duty. The vomiting ceased.

This is a characteristic example of a type of patient whom one would not expect to reach the neuro-psychiatrist, the man with a tendency to take hysterical advantage of minor physical ailments whose path in this direction is blocked by prompt and appropriate action on the station.

Fatigue syndrome and depression were appropriately used and do not need special mention here, since they have been dealt with fully in the clinical report on neurosis in air crews (Chapter X) and will be discussed later in this report.

In many cases *physical symptoms* dominated the picture, and the patient went to see the doctor to obtain relief. The medical officer was usually able to recognise the cause, and it is noteworthy that in only 46 cases of the whole series (16 per cent) were special clinical investigations or opinions, apart from those of the neuro-psychiatrist, called for. In many of these 46 cases some associated physical disorder, such as a recent head injury or unrelated physical defect, furnished sound reason for investigation as in Case 279 :—

Case 279: A Dutch Flying Officer, navigator, radio, aged 31, four night-intruder patrols in Mosquitos. All four sorties had been very eventful. On the first he crash-landed and was trapped in the aircraft, which had caught fire. On the last the aircraft was badly damaged by flak, and he and the pilot baled out. The patient struck the right side of the forehead on landing, had severe headaches, and returned to the station in a very excited condition. After a week's leave he still had the headaches, complained of weakness of the right eye, and was unable to concentrate on reading or on driving a car for more than 10 minutes. He had been subject to headaches and 'eyestrain' since school days : he was considered very highly strung, intelligent and conscientious. The medical officer referred him to an ophthalmologist, who found no abnormality. He was then admitted to hospital, where a small stellate fracture of the right frontal bone was found, but the neuro-psychiatrist did not think that this altogether accounted for his symptoms. He was, therefore, transferred to the R.A.F. Officers' Hospital for psychiatric treatment. His squadron commander had great confidence in him and the prognosis was thought to be excellent.

In several instances as in Cases 134 and 12 (page 93) the medical officer had clearly used reference for a physical examination as part of his psychiatric management of the case; but in one or two cases, as for example Case 55, repeated investigation of physical complaints seemed to show a failure to grasp the true situation.

Case 55: A Pilot Officer, pilot, aged 30, 3,750 hours flying, 3 sorties in day fighters. Ex-Instructor. Complained of muzziness in the head and pain in the left ear. While flying was giddy and deaf in the right ear. This was thought to be due to barotrauma, but flying with an instructor showed that the aural symptoms occurred on ascent and the deafness was thought to be spurious. He then complained of dyspepsia and pain in the epigastrium. He had had a crash with fire, without injury, in 1939, and had baled out successfully in 1940. The M.O. found him 'very keen to talk about his symptoms at great length and not at all keen to go on operations.' He was referred 3 times to an E.N.T. specialist, was given a decompression test, was sent to a medical specialist to have investigated the condition of his alimentary tract,' and then, all tests being negative, was sent to a neuro-psychiatrist. The only treatment given in the station was phenobarbitone. The M.O. thought the prognosis bad.

By contrast to this case it was interesting to observe when studying the case notes how the experienced medical officer in dealing with air crew whose symptoms were related to the psychological strain of their duties avoided sending them to hospital for anything except confirmation of the psychiatric diagnosis. The medical officers who showed in their cards that they had not the confidence to manage the case alone and who delegated the whole problem of treatment and disposal to a neuro-psychiatrist, more often asked for investigations by the ophthalmologist, otologist or general physician before doing so.

3. Causes

Evidence of psychological stress above the average was recorded in the flying experience of 177 men (62 per cent), while stress arising from factors unrelated to flying was noted in 84 (30 per cent). Of special interest was the frequency with which the medical officer commented upon *acute psychological trauma*, which had initiated, precipitated, or accentuated the disorder. A description of such acute trauma was given in 100 cases (35 per cent). The trauma varied in its form, severity and time of occurrence, as will be seen by reference to case histories.

Case 129: A Sergeant, air gunner, aged 19, with 75 hours flying, was involved at an O.T.U. in a severe crash on take-off with two 500-lb. bombs on board. He was uninjured. The next day two of his friends were killed flying from his station. Thereafter he developed continuous anxiety in the air with inability to cope with his duties. He was subsequently grounded.

This case is an example of the most usual kind of acute psychological trauma. Other examples are Cases 135 (page 84), 26 (page 85), 275 (page 86), 225 (page 87).

A temporary loss of confidence as a result of acute psychological trauma may easily infect several members of the same crew. For instance, four cards were returned for pilot, navigator, wireless operator and air gunner, all of whom were flying in a Catalina aircraft which made a forced landing and rapidly sank nose first, and from which they all had difficulty in making their escape. Two complained of headaches and two of loss of confidence in flying, while three returned to full flying duties. Sometimes a man may pass through several intensely distressing experiences, and each may give rise to temporary loss of confidence or anxiety, the outcome of which will depend partly on the unit medical officer. This was so in Case 79.

Case 79 : A Flight Sergeant, air gunner, aged 26, 200 hours flying, 8 night bombing sorties in Lancasters, reported to his unit medical officer with headaches, dizziness and insomnia. On his first sortie with a strange crew the aircraft was badly shot up over Berlin. On his eighth sortie both outer engines cut over Munich, an order to abandon aircraft was given and countermanded ; the aircraft went on to Corsica on 2 engines where it crash-landed, the rear gunner being killed. The patient's wife and mother were opposed to him continuing flying. He was given a rest from flying, admitted to Sick Quarters, and given nembutal, the medical officer used suggestion and encouragement, and the Flight Commander was asked to give him some easy trips. He returned to operational flying and the M.O. stated : " Provided no untoward incidents occur he should finish his tour with no further trouble." On the 15th sortie the crew had to abandon aircraft, the rear gunner's parachute was U/S so he jumped clinging to the patient but was unable to maintain his hold when the parachute opened. Later the patient reported sick with depression and anxiety, his main complaint being of nightmares in which his sister took the place of the rear gunner. He was referred to a neuro-psychiatrist, who advised boarding to non-operational flying. The medical officer's comment was : "A man who has tried hard to carry on but who is unlikely to resume operations. If he does, I would not expect him to complete a tour."

In nearly a third of the cases in which acute psychological trauma had occurred, it was associated with physical injury, especially fractures or burns.

Throughout the case returns the emphasis was upon danger and fear, in contrast to exhaustion and fatigue. Even when fatigue was noted it was often associated with prolonged exposure to the hazards of operational flying as described in Case 284.

Case 284 : A Flying Officer, pilot, aged 23, 1,150 hours with 29 heavy bomber sorties, complained of fatigue, dizziness, blurring of vision and difficulty in concentrating on the dials. He had done two day sorties and two night sorties in the 4 days before reporting sick at the tail end of his tour. He found the day trips particularly trying because of the need to concentrate upon formation flying. He had been doing very frequent sorties in the preceding month. He was found to be moderately predisposed to neurosis. The unit medical officer admitted him to Sick Quarters for 5 days, gave him sedatives, sent him on 10 days sick leave and referred him for specialist opinion. He returned to complete his tour.

Fatigue was presented as a cause of breakdown in 24 instances. This was sometimes the acute fatigue of a short period of intensive operational activity. It was more often the end result of many months of sustained flying. This was particularly the case in instructors (Case 126) and in flying boats of Coastal Command (Case 263).

Case 126 : A Flying Officer, pilot instructor, aged 24, 860 hours, returned from sick leave after naso-pharyngitis and stated that he was so utterly fed up with instructing that he could not bear it any longer and that it was affecting his health. His work involved the repetition of the same routine B.A.T. course every week. The Chief Instructor and a neuro-psychiatrist were consulted and recommendations for early posting to operations were made. The M.O's. comment was : " He is mentally stable. I do not think he will get a posting to operations before his tour of instructing is ended, but I think he will settle down again."

Case 263 : A Flying Officer, pilot, aged 29, 2,300 hours, 600 on anti-submarine offensive patrol in Catalinas, reported sick with a fatigue syndrome after 100 operational hours on his second tour. He complained that the horizon blurred at take-off and that he could see several images of the horizon. He had had similar symptoms at the end of his first tour. The unit medical officer gave the cause of his illness as (1) sorties lasting 14-18 hours ; (2) the responsibility of his duties as skipper with a crew of 9. No predisposition was discovered and he was admitted to hospital for rest and treatment. He was posted for 3 months to non-operational flying with trips not lasting for longer than 3 hours.

An example of a man who developed a fatigue syndrome as a result of intensive flying without much stress was that of a pilot officer, navigator, aged 28, with 170 hours flying, who had had no leave for 3½ months, and had only had one half day off flying in the seven weeks before reporting sick. He returned to full flying after a short period of leave.

4. Predisposition to neurosis

The unit medical officers recognised signs of predisposition to neurosis in the man's past history or in that of his family in 130 cases (45 per cent). This is a considerably lower proportion than in any sample of cases from neuro-psychiatric specialists, who usually find evidence of predisposition in nearly three-quarters of their cases.

Among the factors responsible for this difference are :—

(*a*) The medical officers' lack of psychiatric training.

(*b*) The limitations of an interview in the unit. The patients may not be so forthright in discussing their personal affairs in close proximity to their colleagues and duties.

(*c*) The inclusion of some of the more benign cases which do not reach the neuro-psychiatrist.

For these reasons, and because the subject has been dealt with so fully in other reports, it need not be pursued here.

5. Treatment

The unit medical officer described a constructive form of treatment, carried out by himself on the station in 199 cases (70 per cent). Of the remaining 30 per cent of cases where treatment was not attempted, the explanation was in many instances to be found in the type of case which had presented. For instance 60 per cent of the cases not treated on the station had been given a bad or hopeless prognosis by the medical officer, in 30 per cent a diagnosis of lack of confidence had been made and the matter referred for executive management, and in 38 per cent the man was under training and considered unsuitable for air crew duties. The circumstances of many of these cases show that treatment on the station would have been inadvisable. There were few cases in which the medical officer seemed to have missed the opportunity for helping the man while he was still in the unit.

The kind of treatment which was used by unit medical officers varied of course with the nature of the psychological disorder and the circumstances in which it had occurred. It will be best to give an indication of the broad principles which were followed and to illustrate the method employed by case histories. The first consideration which influenced the medical officer's approach seemed to be whether the man's symptoms in their nature or intensity were worse than those experienced by others who were able to carry on with their duties ; the second depended upon the man's attitude to his duties and to his symptoms—whether or not he was prepared to persevere ; the third was the kind of man the medical officer judged him to be or the amount of predisposition he recognised, and the last was the stage in training or in operations which the man had reached. It was evident, of course, that all these points were used in judging prognosis, and that the medical officers were consequently influenced in their management of the case by their view of its outcome. There is an important result of this attitude, which depends upon the medical officer's relation to his squadron. Those who have confidence in their ability to sustain the weaker members of the squadron will institute a well considered course of treatment, will enlist the co-operation of executive officers, and will go to great lengths to save the man from grounding, while those medical officers at the other end of the scale, who think it either unprofitable or impracticable to adopt such a policy will precipitately refer their patients to the nearest neuro-psychiatric specialist with a sigh of relief, an echo of which reached us in the card returns. Examples are given in cases 87 and 191 (page 93).

Case 87 : A Sergeant, air gunner, aged 34, with 145 flying hours, reported sick after three night bombing sorties in Lancasters, and complained of a dread of flying and particularly of operational flying, of which he was ashamed, of feeling tense and nervous all day, and of fits of depression. He has had no special stress, but the medical officer considered the cause of his illness to be the commencement of his first operational tour. He was described as having a cyclothymic temperament, never sticking at a job for long. He had been in the Merchant Navy and the National Fire Service before joining the R.A.F. For 13 years, after an ulcer on a tonsil in 1930, he had persistent fear of cancer of the throat. This was largely dissipated by explanation. Having interviewed the patient at length and obtained a history of his personal illnesses and of his past life the following treatment was instituted by the unit medical officer. He was admitted to the Station Sick Quarters for 48 hours for a rest ; he was put to bed and given 3 grs. nembutal that night ; he was also given 15 grs. of sodium bromide three times a day ; the medical officer ' convinced him that all other crews feel as he does when they first operate, but nevertheless they continue with their job ; ' the captain of his aircraft, the squadron commander and the gunnery leader were in turn interviewed by the medical officer, who described to them the defects in the patient's personality and the difficulty he was having in performing his duties. They were asked to encourage him throughout his tour as much as was possible. The patient was then sent to duty, continuing medical treatment for 48 hours, and having flown again was sent on a short period of leave. After this the medical officer made the notes " Encouragement + + from myself, the wing commander, flight commander, gunnery leader and the captain." He noted that the 4th operational sortie was successfully completed, and considered that the tour would continue successfully although the patient might require early screening. Follow-up six months later revealed that the patient had continued his tour satisfactorily until on his 22nd sortie his aircraft crashed in Sweden and he was killed.

In contrast to this case, in which a greatly handicapped member of a night bomber crew had been sustained from his third sortie until his death in the 22nd sortie, is the following case. Here with less cause the responsibility for treatment was transferred by the unit medical officer to the psychiatrist.

Case 191 : A Flight Sergeant, bomb aimer, aged 24, 450 hours flying, 30 operational hours, engaged in container dropping, complained of insomnia, nightmares, anxiety, tremors and fear while flying. Six months before his aircraft had made an uneventful forced landing, he saw an aircraft shot down on his second sortie, and two weeks before reporting sick his aircraft had overshot with damage but no injury to the crew. He had also sustained psychological stress apart from flying, for a year previously his fiancee had married a man who was also operating from the same station, and who was reported missing a week before he went sick. He was a well-educated man, without evidence of predisposition. As soon as the patient had reported sick the medical officer arranged an interview with the neuro-psychiatrist and the patient was admitted to hospital for treatment. Although he had taken no active steps to treat the patient on the station, the medical officer thought there was " a reasonable chance of recovery in a reasonable type."

Two hundred and seven of the cases (72 per cent) were referred to a neuro-psychiatrist and 47 (16 per cent) were referred for another specialist opinion, usually ophthalmic, medical or E.N.T. Forty-one (14 per cent) were subsequently admitted to hospital.

An indication of the form of treatment used on the station is given by the following observations. Of the 199 patients who were treated on the station, 157 (nearly 80 per cent) received psychotherapy, a brief outline of which was given on the cards. In so far as all the patients were interviewed by the medical officer they all received psychological treatment, but in 80 per cent a note was made of explanation, persuasion, or suggestion, usually reinforced by other methods, such as taking the man into the air, sending him on leave or admitting him to sick quarters. Ninety-two (46 per cent) were given medical treatment. In most instances this was mild sedation, such as 3 grains of nembutal or 10 grains of medinal, but in some it included symptomatic treatment of a simple kind, such as alkalis for dyspepsia, or local nasal treatment. This symptomatic treatment was usually administered with evident knowledge of its psychological value.

Sixty-five men (a third of those treated on the station) were given a temporary rest from flying, which ranged from 48 hours' leave or a few days ground duty on the station, to 7 or 10 days' leave, and sometimes an arrangement was made with the squadron commander for temporary relief from particularly hazardous operational sorties. In 27 instances (14 per cent) the medical officer advised posting from the unit to other duties, particularly when the operational tour was nearing its completion—so called 'accelerated relief employment'. An example of the kind of case in which this was advised is provided by Case 184.

Case 184 : A Warrant Officer, navigator bomber, aged 22, had flown 780 hours, 480 on Leighlight and offensive anti-submarine Liberators, reported sick with episodes of depression. He experienced confusion and excitement before an operational sortie, complained of inability to concentrate on his job, when approaching land, particularly in bad weather, experienced insomnia and nightmares and found that his behaviour was becoming unsociable. The symptoms had been present in mild degree for five months and severely for four or five weeks. He had experienced considerable flying stress. On his first tour he was shot into the sea by a U-boat and received injuries. He was on his 60th sortie. There was no evidence of neurotic predisposition. He was grounded, admitted to Sick Quarters and given 1½ grs. nembutal at night for a week. He was interviewed three times by the medical officer who then advised termination of his tour of operational duty with accelerated relief employment which consisted of instructional duties at an O.T.U. The recommendation was implemented and the patient recovered. The medical officer commented : " I regard this W/O as a good trier, but one who was unable to complete his second tour on account of a weakened response to the stress of his trade which had been caused by his previous experiences".

Sometimes loss of confidence for operational flying may be overcome when some of the leading factors which handicap the man are removed. Two interesting examples of a satisfactory outcome from such a temporary loss of confidence which was brought about by treatment helped by a change in the loading factors, are given in Cases 261 and 204.

Case 261 : A Warrant Officer, wireless operator, aged 34, with 1,000 hours, had flown 900 operational hours in Leighlight Liberators on anti-submarine patrol. He was referred to the medical officer by his captain for 'suspected fear of flying duties because of dwindling keenness and nervousness during landing'. The patient asked for transfer to Flying Boats. Two years previously he had been in a Sunderland which made a forced landing in the sea after anti-aircraft damage over Norway. A year previously he sustained an injury in a heavy landing in a Catalina, and he said he had a phobia for the cramped accommodation in a Liberator. No evidence of predisposition was discovered. He was seen by the medical officer on two occasions, and the causes of his symptoms were explained to him. He was encouraged and persuaded to return to duty. He was later referred to a neuro-psychiatrist, who made a diagnosis of lack of confidence and on his return to his unit from this appointment a firm attitude was adopted towards him after consultation with his wing commander, who returned him to full flying duties with a different and senior crew. On his first sortie with this new crew the aircraft developed engine trouble and had to make an emergency landing at base. The captain immediately changed to another aircraft, and while on patrol successfully attacked a U-boat. From that time on the patient was confident and enthusiastic for operational flying in Liberators.

In this case confidence was restored by success. In the following case confidence returned when great domestic anxiety ceased.

Case 204 : A Flight Sergeant, engineer, aged 32, 500 hours' flying, 380 operational in offensive anti-submarine patrol in Catalinas, reported with persistant anxiety in the air of two months' duration. He had no symptoms on the ground and simply asked to be removed from flying duties. He had been flying one 18-hour sortie every five days for many months. After nine years of marriage his wife deserted him, taking his two children. She obstructed divorce proceedings and the patient feared that if he were killed his money would revert to his wife and not to his children. The medical officer commented that the patient was a very sound type with a good work and Service record, and his squadron commander also had a high opinion of him. They adopted a sympathetic attitude to his loss of confidence but, in spite of explanation and persuasion, his attitude was unchanged. He was therefore temporarily grounded; a neuro-psychiatrist who saw him confirmed the good impression but could find no evidence of neurosis, and advised executive disposal with a strong medical recommendation in the man's favour. In the meantime the divorce was agreed to and was to have been completed satisfactorily for the patient within a few months. The Flight Sergeant promptly asked to return to operational flying and the medical officer gave him a good prognosis on the grounds that he was "a good type, he had had severe domestic anxiety for two years and he had had intensive operational flying". He returned successfully to operational flying.

It might well be argued that in some cases it would be more profitable to remove a man from flying rather than seek to sustain a weak member of a crew in duties for which he shows unsuitability. Case 15 seems to be an example of such a case, where misplaced encouragement was given to an unsuitable member of air crew.

Case 15 : A Flying Officer, air-gunner, aged 35, with 100 hours' flying, was seen at a heavy bomber O.T.U. complaining of vague pain in his right ear, backache, pain in his left calf and poor sleep. The history showed that he was a slightly unstable type, who volunteered for air crew because he was on a pansy job (Catering Officer). After completing training at a Sunderland O.T.U. he complained of backache, was submitted as a case of lack of moral fibre, but subsequently granted his request to convert to medium bombers. Instead he found himself at a heavy bomber O.T.U. The medical officer treated him with reassurance, sedatives, and local treatment to his ear and kept him at duty. The note under prognosis was " Has been posted to a Conversion Unit now. Apparently the captain of the crew expressed dissatisfaction with him before they left. I think the prognosis is poor in this case, and doubt if he will ever become operational ".

So far, in discussing treatment, it has been assumed that fear has been the important factor in the aetiology, but the management of the few cases in which the illness had been mainly caused by fatigue may be rather different. Here the course adopted, depending upon the severity of the symptoms, was to advise temporary grounding as in Case 18 (page 85), leave as in Case 284 (page 91) or a period of non-operational flying as in Case 263 (page 91).

In order to complete an account of the forms of treatment, the methods used in cases where symptoms were slight, but where the man professed himself unable to continue operational flying should be mentioned. Here the medical officer may recognise the lack of confidence as being a temporary affair, perhaps the result of a recent unpleasant episode and may persuade the man to reconsider his decision. Sometimes, too, the medical officer may recognise sources of anxiety unconnected with flying duties. Case 204 (page 94) is a good example of this.

In some instructors, who had been employed on non-operational duties for long periods, posting to operations comes as a rude shock. Morale may be deviated away from offensive flying, and it is the unit medical officer's duty to attempt to give the man a correct orientation to his duties (*Case* 264).

Case 264 : A Flight Lieutenant, pilot, aged 32, 1,500 hours, mainly instructing, was posted to a Photographic Reconnaissance O.T.U. He wrote a letter to his commanding officer stating that he was 32, and that the British climate did not agree with him, that he felt tired at the end of his training flights and that he could be of more use in a non-operational job, especially as a younger man would do operational trips better. He had previously complained of pain in the groins, for which no cause could be found but he was unduly worried about it. He had been instructing on Tiger Moths for three years before transfer to Mosquitos. The medical officer said : " He was happy in his rather nice job instructing, and it comes as rather a shock that he is expected now to do operations in Mosquitos". He was considered predisposed to neurosis. At interview he was found to be quite well. The position was explained to him and the implications of his attitude to his duties made quite clear. He was then referred to his Chief Instructor for a similar interview. He consequently withdrew his application to be removed from operations and continued willingly. The unit medical officer's final comment was : " He had been training so long that he had lost sight of the fact that he might have to do operational flying. He should do well with encouragement and occasional reassurance about his health over which he worries unduly".

6. Results of treatment

The outcome of treatment on the stations may be judged from the 127 cases in which a final disposition had been made after treatment was complete : 54 of these (42 per cent) returned to full flying and 7 (5 per cent) to limited flying ; 26 (20 per cent) were grounded ; 39 (31 per cent) referred for executive disposal. The final outcome of treatment in all the cases is unknown since the final disposal has not yet been made in the remaining 72 cases. It seems, however, that nearly a half of the cases treated on the station return to flying duties, compared with a third of the cases interviewed by a neuro-psychiatrist (Chapter XI).

7. Prognosis and disposal

An opinion on the ultimate prognosis for flying duties was given by the medical officer in 259 cases, as follows :—

	No.	*Percentage*
Good prognosis	76	29
Doubtful prognosis	50	20
Bad prognosis	92	35
Hopeless prognosis	41	16

It will be seen that in half the cases little hope was entertained of continued efficiency. The prognosis was considered to be better when a neurosis was diagnosed, a bad or hopeless prognosis being given in 65 per cent of those considered to be lacking in confidence. The disposal of the patients followed the prognosis for flying very closely, so that considering the patients who had been given a final disposal, 92 per cent with a good prognosis, 78 per cent with a doubtful prognosis, 29 per cent with a bad prognosis, and none of those with a hopeless prognosis returned to flying duties.

So far the disposals of the men treated on the station have been given, and (in the preceding paragraph) the disposals of those in whom the prognosis was good or bad. Information on the final disposal was available at the time of writing in 200 instances :—

	Cases	*Percentage*
Full flying	70	35·0
Limited flying	7	3·5
Executive	63	31·5
Grounded	59	20·5
Invalided	1	0·5

Reference to Chapter XI shows that these figures are almost identical with those for all cases referred to neuro-psychiatrists in the preceding year. As the great majority of the cases here reported were referred to the neuro-psychiatrist after seeing the unit medical officer, it is evident that the psychiatrist must have influenced disposal. In this connection it is to be observed that out of 286 members of air crews seen by medical officers on the station, 207 (nearly three-quarters) had been referred to a neuro-psychiatrist within a period of seven months from the commencement of the card return by medical officers. Of the 97 cases labelled lack of confidence, only 59 (60 per cent) were referred for a neuro-psychiatric opinion, for in these cases the station authorities, medical and executive, are urged to handle the matter with the greatest expedition, and there is opportunity later for obtaining a psychiatric opinion before disposal is decided. Thus, of the remaining cases in which the medical officer recognised the presence of psychological illness, he referred more than three-quarters to the neuro-psychiatrist. The main reasons for reference seem to have been a bad prognosis with need for medical disposal; failure of treatment on the station; or the wish for expert backing in making the diagnosis of anxiety rather than lack of confidence. As already indicated there were some cases in which reference to the neuro-psychiatrist appears to have been premature or unnecessary. The results of treatment on the station on the whole were good and in the hands of some medical officers were excellent, and this investigation supports the view that cases of early neurosis in air crew should be handled in the first place by the unit medical officer rather than referred for specialist treatment.

8. Instructions to Medical Officers on disposal of cases

(*Appendix to FPRC* 412(*k*))

(*a*) At the direction of the D.G.M.S. an investigation is being carried out into the number and types of cases of psychological disorder in flying personnel seen by medical officers on stations, and their disposal. Medical officers will co-operate by providing data from the date indicated by Senior Medical Officer, Group, until further notice, upon all flying personnel seen by them for complaints which have no physical bases, or who having no physical disability, state that they feel unable to carry on with flying duties. All cases of neurosis, and all men lacking confidence will be included in the survey, and it is essential that a return should be made for every case however trivial or transient the disturbance may be. *The individuals concerned should not be allowed to know that the information is being recorded. The information received from medical officers will be treated as confidential and will be used for research purposes only.*

(*b*) The case return is simple—merely filling in one of the enclosed cards according to the instructions given below. The card will be initiated by the medical officer when the case is first seen by him and will be completed and returned, under confidential cover, through Station Sick Quarters to the S.M.O. Group *twenty-one days later*, irrespective of the date of disposal. If after twenty-one days the disposal (vide instructions below) is altered or has been delayed a fresh card will be initiated—headed "2nd Card"—and rendered at the earliest possible date. The S.M.O. Group, who is responsible to Command for the efficiency of the scheme, will forward the card forthwith to the Central Registry of Psychological Disorders in Flying Personnel.

In filling in the cards the following points should be noted :—

File No	Leave blank.
Air crew category	i.e., pilot, bomb aimer, navigator, etc.—not to be confused with duties.
Duties	i.e., instructor, U/T, night bomber, day bomber, day fighter, fighter-bomber, night fighter, coastal boats, G.R., bomber, torpedo-bomber, bomber anti-sub, air/sea rescue, Met., P.R.U., etc.
Diagnosis	The psychiatric diagnoses have been limited to the four most important. Delete those non-applicable. *Fatigue syndrome* should be reserved for cases in which sensation of mental or bodily fatigue or undue fatiguability are outstanding complaints. It is synonymous with *neurasthenia*. If more than one reaction type is present they should be numbered in order of importance. (If a diagnosis cannot be made, delete all and give an outline of the case under *Symptoms*.)
Main symptoms	A very few words with an indication of the duration of the disorder.
Main causes	*Flying*.—An outline of the hazards or fatigue he has experienced over and above the average to be expected in the number of hours flown. *Non-flying*.—Worries about home, health, money, etc.

Predisposition to neurosis ..	Any history of nervous or mental illness in the patient or his family, or of excessive timidity or instability in civil life which comes to light in the interview, and which may give you the impression that he is temperamentally unsuited for his duties. *Do not ask questions about family or past history which might upset the patient or impair his confidence in himself.*
Treatment	A note of the methods you used, e.g., explanation of symptoms, encouragement, persuasion, whether one interview or more, rest from flying or operations, sedatives, leave, early termination of tour.
Disposal	Should indicate what happened to the man after treatment by the medical officer, e.g. :— (a) returned to full flying after treatment on the station. (b) referred to S/Ldr. ...., Neuro-psychiatrist. (c) seen by commanding officer and returned to full flying. (d) seen by commanding officer and dealt with as case of lack of confidence under S.7 letter.

Specimen Card

(front)

Name ROBINSON, J. C. *Rank* F/O *No.* 938251 *Aircrew* Pilot *Category* *Age* 25	*Unit* 15 Squadron *Station* Mere *Total hrs.* 450 *Op. hrs.* *or Sorties* 27 sorties *Aircraft* Lancs. *Duties* Night bomber	*File No.* *M.O.* S/Ldr. Bloggs *Diagnosis* Anxiety Depression Fatigue syndrome Hysteria Lacking confidence
Main symptoms ..	Sleepless and dreaming of flying. Depressed and anxious about his home life. Losing weight—solitary in mess. Asks to come off flying.	
Main causes	*Flying* Had two difficult trips in one of which Rear A/G killed, and back on 3 engines to crash land at base. *Non-Flying* Wife pregnant.	

(reverse)

Predisposition	Nil discovered, but strikes me as always having had to drive himself to the job.
Treatment	Seen twice—given nembutal gr. iii and a night in S.S.Q. second time. Long talk in which he said he was afraid. Told his W/Cdr. about him.
Disposal	To duty for posting to O.T.U.
Prognosis and comment	Likely to make a good instructor and do a second tour. An average good type who had a little difficulty in staying the course.

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CHAPTER VIII

THE HUMAN RESPONSE TO FLYING STRESS*

by

Air Vice-Marshal Sir Charles P. Symonds, K.B.E., C.B., M.D., F.R.C.P.

December, 1943

LECTURE I : NEUROSIS IN FLYING PERSONNEL

1. Historical

When Dr. James Birley (1920a) gave the Goulstonian Lectures twenty-three years ago on Medical Science and Aviation he described in words which have lost none of their freshness and vigour the picture of what he called flying stress, and because this term has been widely employed I shall begin by explaining the sense in which Birley used it and the change of meaning that has since taken place. Birley and his colleagues were confronted with the twofold problem of studying, first, the unknown factors of stress to which the airman was exposed, and, secondly, the effects of this stress upon the human organism. Unfortunatley, as so often happens in the study of functional disorder, the distinction between causes and symptoms was in the end ignored, and 'flying stress,' which was appropriately coined for the load which the airman had to carry, was later used to describe the state of ill-health which resulted when this load was too heavy. Flying stress, in fact, became a clinical diagnosis.

The implication that the occupation of flying had resulted in a new disease found ready acceptance not only because the occupation was so new and so dramatic but because there seemed evidence that lack of oxygen, which at that time was inevitable in high flying and unknown in any other occupation, could cause functional nervous disorder of a widespread and long-lasting kind. It was certain, at any rate, that a person actually suffering from anoxia showed psychological disorder as well as other symptoms. It was assumed that repeated exposure to anoxia might lead to persistent effects of the same kind. Thus Flack (1920), who was one of the pioneers in aviation medicine, attributed nervousness, insomnia, lack of confidence, and disinclination to fly to this cause. Birley (1920b) soon became suspicious of this opinion, for he observed these symptoms in men who had not flown at high altitudes. He suggested that the cause in these cases was occupational fatigue. The position of flying stress as an occupational disease was thus upheld. Later, however, he noted that the same symptoms might be seen in men who had neither flown at high altitudes nor flown long enough to suffer from cumulative fatigue. He observed that in this group there was often a family or personal history of neuropathy, and suggested that here there was temperamental unfitness "which," he said, "lies largely in an undue susceptibility to mental shock, to which these individuals react primarily by various mental and psychical phenomena and secondarily by various alterations in their physical state."

How far this last observation has been confirmed and extended during the present war I shall hope to show. I may anticipate now by saying that there is no more warrant for the use of *flying stress* as a term of clinical diagnosis than there was for *shell-shock* which, it was agreed by the War Office Committee (1922) appointed to inquire into the subject, was wholly misleading,

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" and should be eliminated from official nomenclature, the disorders hitherto included under this heading being designated by the recognized medical terms for these conditions." The objection to the use of *flying stress* as a diagnosis of course applies equally to other terms such as *aeroneurosis* and *aviator's neurasthenia*. All are founded upon error, and might well—as shell-shock did—have become a danger to morale. *Flying stress* should be used only to denote the load which air crews have to carry. For the ill effects which may result in some persons from overloading, terms of ordinary clinical usage will suffice.

2. Scope and methods of present investigation

In our study of functional nervous disorder in flying personnel during the present war we began with certain advantages. Before long the apparatus for maintaining oxygen supply at heights had been so perfected that it was usually possible to exclude anoxia as a casual factor unless there was evidence that the apparatus had not been properly used or had gone wrong. Our view of the neuroses also was broader and deeper than had been possible 25 years ago. Our approach to the problem rested upon the belief that the symptom pattern or reaction type of a neurosis cannot be related to any single cause—that an anxiety state, for example, may have as its main cause emotional conflict, infection, or exhaustion ; and that, standing between environmental stress and symptom pattern, individual constitution is all-important.

At the direction of Air Marshal Sir Harold Whittingham, Director-General of Medical Services, for some time all cases of neurosis in flying personnel have been analysed on the basis of data collected by the neuro-psychiatric specialists of the Royal Air Force. The inquiry was restricted to cases seen by the specialists, with the knowledge that this would exclude some of the milder cases ; but the restriction was necessary to obtain data of consistent value, and it is certain that almost all flying personnel in this country and in the Middle East in whom there was any question of unfitness for full duty on account of functional nervous disorder were seen by the specialists, and are included in this investigation. The specialist fills in a card for every case seen, sending it to a central registry, where the data are extracted. The information recorded in addition to the particulars of the man's service, flying hours, and tactical duties includes the reaction type of the illness and the main casual factors. Three further questions are set. One is concerned with flying, and is in two parts. First : has the illness arisen from *flying duties*, and, if so, what were the incidents responsible? Second : what was the weight of *flying stress* to which the patient had been subjected? Our instructions on this point are that the assessment of flying stress as nil, slight, moderate, severe, or exceptional should be made in relation to the average load carried by healthy persons in this occupation. The problem was not whether the man in question had had to carry more than he could manage, but whether the load had been greater than that which the ordinary man could take. The next question asks for an estimate of *non-flying stress*—for example, domestic worries—as nil, moderate, or severe, with relevant data. The last requires an estimate of *predisposition* to functional nervous disorder as nil, moderate, or severe, again with supporting data if the assessment is positive. The agreed criterion for severe predisposition is that the specialist considers that if he had seen the man as a candidate for flying he would have advised rejection. A few case summaries will illustrate the nature of the material collected.

3. Cases illustrative of predisposition and stress

Case 1 : Sgt. X., pilot, aged 23, flying hours 190, operational hours *nil*. His father had suffered from an obsessional neurosis, and he himself had been away from school for six months at the age of 9 owing to what he described as " a mania for tapping things and screwing his eyes up." He always tended to worry unduly over small things. He had no unpleasant experience in training or any personal worries, but when he began flying Hudsons the noise of the engine, he said, " got on his nerves." He could think of nothing else, and developed headache and insomnia. This is a straightforward example of an obsessional neurosis in a man who would never have been accepted for air crew had his history been disclosed. Although flying duties had contributed to the breakdown, flying stress was nil. Non-flying stress was also *nil.* Predisposition was severe.

Case 2 : Fl. Lt. Y., D.F.C., pilot, aged 23, flying hours 600, operational hours 120 in day bombers (25 sorties).—This officer presented with headache, insomnia, anxiety, depression, and loss of confidence for flying. There was no evidence of neurotic predisposition. He had gone through an operational tour with distinction at a time when casualties were heavy. He then married and had been flying on instructional duties for a year. His symptoms developed when he himself was unfit (a fortnight convalescent from appendicectomy) and his child died suddenly. The neurosis (anxiety and depression) was not considered attributable to flying duties. He was a man who had been submitted to a slight degree of flying stress. Predisposition was *nil,* non-flying stress severe.

Case 3 : P/O Z., G.M., pilot, aged 27, flying hours 240, operational hours on day bombers 100. This officer had since childhood been unduly sensitive to slights, easily depressed, and lacking in confidence. His squadron suffered heavy casualties, and eventually he was wounded in the leg on a sortie over the North Sea. He flew his damaged aircraft home, but it blew up on landing. He won the George Medal for pulling his air gunner out of the blazing wreckage. After two months in hospital he was physically fit to fly, but was tense, anxious, depressed and self-reproachful. The illness here was clearly attributable to flying duties. Flying stress was rated as severe. Predisposition was moderate, non-flying stress *nil.*

Case 2 is representative of a group in which the neurosis, though resulting in incapacity for flying duties, was due to causes unrelated to flying. Excluding this group and confining our attention to neuroses which have arisen from flying duties, we have asked ourselves among other questions what are the important factors in causation, how the neurosis develops, and what are the commonest reaction types. With this purpose the data recorded on a consecutive series of 2,000 cases have been analysed, and as a separate investigation representative station and squadron commanders as well as medical officers in the Training and home-based operational commands have been interviewed by Squadron Leader Denis Williams and myself and asked these two questions : " What are the things which get men down ? " and " How do you know when a man has had enough ? " It was hoped that this inquiry, systematically developed, would give us a better idea both of causes and of early symptoms than can be obtained from the evidence of men who have developed a neurosis. Actually it did more than this, for many of the 200 flying personnel interviewed volunteered accounts of their own reactions to stress. Such introspective material furnished by distinguished officers of great experience has been a valuable addition to our knowledge. The records of cases of neurosis seen personally have provided an additional source of information. Some of the conclusions reached by these means will be briefly presented.

4. Distribution and causes of neurosis

There has been no difficulty in the classification of cases under the ordinary clinical headings. Anxiety states occurred in 79 per cent of the cases, depressive states in 9 per cent, and hysteria in 13 per cent ; mixed forms were not infrequent—hysteria, for example, being often grafted upon an anxiety state. Our tables, which cannot for Service reasons be published now, show that the incidence of neurosis in different tactical duties varies directly with the amount of hazard encountered, as measured by the casualty rates. It is thus lowest in Flying Training Command, highest in night bombers. In duties which involve long trips with relatively little hazard the incidence of neurosis is low, suggesting that emotional tension is a more important factor than physical or skill fatigue. That skill fatigue is probably an operative factor is shown by a rather higher incidence in pilots than in all other members of air crew taken together ; but the highest for a specific duty is among rear gunners of heavy bombers, where skill fatigue is negligible but emotional tension high. Although causal factors of a physical kind have been systematically inquired for—exhaustion, air sickness, altitude effects, cold, physical injury, and illness—they have been recorded in less than a third of the cases, and then generally as subsidiary factors. Altitude and cold were in fact not recorded in any case. By contrast, psychological factors have been present in 99 per cent of the cases.

We have found plenty of evidence to support Birley's suggestion that temperamental unfitness for the job was an important causal factor. More than two-thirds of our cases show what he referred to as a family or personal history of neuropathy, which in this investigation we have called predisposition to neurosis. These men are vulnerable to stress, and the severely predisposed often break down over flying duties without being exposed to any flying stress as judged by average experience. At the other extreme stress may be severe enough to cause a breakdown in men with no predisposition. In the intermediate group the inverse relationship between flying stress and predisposition is striking, so that it can be stated that the more flying stress a man has experienced before breaking down the less evidence of predisposition will be found in his history.

Percentages of patients with varying predisposition exposed to differing degrees of stress

Predisposition	No.	Flying stress					Non-flying stress		
		Nil	Slight	Mod.	Sev.	Exc.	Nil	Mild	Sev.
Nil	604	18	27	33	20	2	62	34	4
Moderate ..	1,173	30	30	28	11	1	64	33	3
Severe ..	423	47	32	15	6	0	64	33	3

This table shows that non-flying stress is almost indentical in the three groups, and that it is the flying stress which is responsible for the reciprocal relationship between stress and predisposition, since it falls steadily as predisposition increases in the three groups.

As would be expected, the amount of flying stress rises steadily with the number of hours flown, and especially with the number of operational hours. Corresponding with this, our figures show that the more flying experience, and especially the more operational experience, a man has had before breaking down the less likely we are to find predisposition. In fact, the severely predisposed individuals tend to break down relatively early in their flying career, leaving those with less or with no predisposition either to succeed or to break down later as the result of greater experience and greater stress.

Among the cases in which the neurosis was mainly attributable to flying duties, factors included under non-flying stress had contributed in 36 per cent These factors might of course be physical or psychological, but were in fact almost always the latter and usually arose from domestic anxiety. In this connexion it has been of interest to observe that the incidence of non-flying stress is higher in married than in single men, and that among operational air crew it has been highest in the Middle East Command, doubtless owing to the anxieties inseparable from prolonged service abroad.

In our assessments of predisposition we have been guided by the principles of general clinical experience and by the special experience of flying personnel who have broken down. The importance of family and personal history in relation to the risk of neurosis under conditions of active service has received attention in papers published during the present war by Curran and Mallinson (1940), Hadfield (1942), Love (1942), and Cooper and Sinclair (1942). Gillespie (1942) has emphasized the frequency in childhood of a history of specific tendencies indicating timidity and lack of aggressiveness in flying personnel who have developed neurosis under the strain of flying duties, and our joint experience has confirmed the value of his observations. As an example, the avoidance of diving by a practised swimmer is evidence of a kind of timidity often found in the past history of those with neurosis. The validation, by follow-up, of the prognostic value of such traits is likely to be of practical value for selection. We do not know yet what is their distribution among those who succeed. We have nevertheless some ground for belief in the practical value of our criteria, for the investigation of unselected air crew by the same methods and by several observers working independently has shown the incidence of predisposition to be four and a half times lower than among those who have broken down.

The quantitative assessment of the abstraction flying stress proved less difficult than was anticipated. Its success is shown by the striking uniformity of the percentage of cases recorded as exposed to the different degrees of stress in the various operational commands, and the consistency of assessments made independently on the same case by different observers. The specialists had, of course, already had considerable experience of Service flying conditions when the investigation began.

5. Fear as an element of flying stress

Evidence has already been presented for the conclusion that the most important element of flying stress as a cause of neurosis is exposure to danger. This is confirmed by analysis of the psychological causes which were held responsible in 99 per cent of the cases of the series under review ; for the story in most of them is that of a persistent state of fear resulting from either excessive stimulation of this emotion in men without predisposition to neurosis or from a lesser stimulus in the predisposed. This, again, simply confirms previous observation in other combatants (Mapother, 1935 ; Dillon, 1940 ; Love, 1942 ; Cooper and Sinclair, 1942). It is evident, therefore, that in the prevention of neurosis in flying personnel serious consideration should be given to the subject of fear.

Fear is a state of feeling which is only strictly ascertainable by introspection, though it is often associated with behaviour indicating a tendency towards flight and with bodily disturbances which have been extensively studied by physiologists. The objective study of fear can never take us to the heart of the problem, but studies of the reactions of young children to situations of a kind which excite fear in adults are of value in tracing the origins of the fear response. The observations of Valentine (1942) are of especial interest. It appears that there are innate trigger mechanisms which provide for a constant behaviour response to certain stimulus patterns. These triggers, however, are not all present at birth. Most of them mature later. For example, a fear response to the dark was not observed by Valentine before the age of two, but was of common occurrence at later ages. There is considerable individual variation in the number and selective response of these innate responses. One child, for example, may show fear responses to fewer fear situations than the average ; another may show more than the normal sensitiveness to a particular type of situation, such as a moving animal. This last observation is of especial interest in connexion with the specific irrational fears or phobias of adults, which may be associated with relative fearlessness in other directions and appear in some cases to be inherited. Granted these trigger mechanisms, it may be argued that fear responses to more complex situations are built up in the manner of conditioned reflexes. This hypothesis leaves out of account the question of the existence, as a part of the original trigger response, of the effective quality which is fear. Valentine's critical comment deserves quotation. " We can," he says, " only distinguish these responses from mere reflexes by saying that they are at least the first of a series of responses which, remaining and developing within a corresponding series of external conditions, are eventually known by adults to be accompanied by the emotion of fear."

The experimental observation of fear in animals is obviously fraught with greater difficulty, for there is never the opportunity of establishing the association of behaviour with feeling. Nevertheless, as Bard (1939) remarks, we are justified in asserting that a dog or a cat is displaying rage or fear without committing ourselves to the determination of its subjective state. Accepting this limitation, we may take note of the spontaneous display of fear following experimental lesion of the hypothalamus. Here is evidence suggesting that the affective state of fear may exist independently of any perception or idea of danger. There is clinical evidence to support this. In some cases of affective disorder the patient's complaint is that he feels afraid though there is nothing either in fact or in imagination which should cause this feeling. There is suggestion here of a central mechanism for the generation of affect, which under certain abnormal conditions may result in a fear state arising or persisting without activation by the stimuli which normally excite it.

The observation of bodily changes such as pulse rate or sweating is of little value in ascertaining the presence of fear, for they are common to other emotions. Physiologists in their analysis of these bodily changes have emphasized their value as preparation for adequate response to danger. Less attention has been paid to the psychological value of fear. It is nevertheless widely recognized that fear, within limits, is not only a natural but a healthy emotion, stimulating attention, sharpening judgment, and evoking maximal effort. I have frequently heard the opinion from distinguished pilots that fear in due measure may be a vital asset in reacting to an emergency, whether in flying or in combat, and that the absence of fear in a situation of this kind may be fatal to success.

Fear of course is often felt in the absence of actual danger. The most familiar example is anticipatory fear, or apprehension, either of real or of imaginary dangers. This, again within certain limits, may be valuable. An experienced squadron commander told me that he liked a man to have enough imagination to fear the worst and hope for the best. Thus he would set forth on his operational sortie prepared for every hazard, and would be more likely both to succeed and to survive than the more phlegmatic types. Incidentally, he added that this kind of man, though he was most likely to give good operational service, was most likely to suffer from the effects of stress. Another common and interesting example of fear in the absence of actual danger is that which, after danger is past, may be experienced by an imaginative person when he reflects upon a narrow escape. Here it seems that the magnitude of the impending disaster has been such, or its passage so swift, that full perception is delayed. The more time and opportunity there is for reflection the greater the tendency to the development of this delayed fear reaction. Thus the man who has been hurt in a flying accident and lies idle may be at a disadvantage by comparison with his comrade who after the same accident remains on duty, his mind occupied with other matters. This does not mean that retrospective fear is inappropriate or unhealthy. On the contrary, it may be of value in pointing experience. The fighter pilot if he has the right spirit gains in value from a narrow escape in combat. Fear within certain limits is a stimulus ; only when it exceeds these limits is it a weakness.

The presence of fear after danger is past is not always to be explained by reflection and rumination, for it may be recognized by the subject as irrational. Mosso (1896) observed this point. After a fear response which has been due to misinterpretation of a situation the individual discovers his mistake and is glad; yet the 'perturbation and oppression do not at once subside, but continue to annoy for some time. They are like the continued vibration of a cord that has been shaken—like the echo of a sound reverberating in the nervous fibres and slowly dying away'. This tendency for fear to perseverate may be observed in many persons if the stimulus has been violent ; but in relation to stimuli of average intensity it is remarkable in certain individuals, suggesting an innate propensity to react in this manner.

I have referred to the value of fear as a stimulus within certain limits. It is necessary now to define these limits. They are set by standards determined not only by the needs of the individual but also by those of his social unit. For both these needs it is essential that emotions other than fear should have free play—anger and loyalty, for example. It is when fear dominates the mind to the exclusion of other emotions that it becomes harmful. "The phenomena of fear, which may be useful in lesser degrees, become morbid and fatal to the organism as soon as they exceed a certain limit : for this reason fear must be looked upon as a disease" (Mosso). For the combatant group, whether air crew, ship's company, or platoon, fear in excess is of course a deadly disease —so much so, that during the last war it must be camouflaged and called "wind up". The ancients also felt it necessary to disarm fear, and used their conventional method of appeasement. Alexander of Macedon offered up sacrifices to Fear before he went into battle. In Naples there are two Roman medals, one of which bears the impression of a terrified woman, the other of a man with hair on end and staring eyes. They were struck in fulfilment of the vows made by the Consuls before a certain battle to propitiate fear, which threatened to invade the ranks of the soldiers, who after this measure had been taken were led to victory. It is interesting to observe, in the books and plays already produced by the present war, frank reference to fear, and to speculate upon the reasons which have allowed this. Whatever these may be, for us who study flying stress it is an advantage to discard the old convention and to admit fear in excess as the kernel of our problem. As Mosso remarks in his spirited introduction to this subject : "The time has come when we must throw off our professorial robes, tie on our aprons, roll up our sleeves, and begin the vivisection of the human heart according to scientific methods".

Although fear is frankly admitted by flying personnel individually in their published records of combatant experience, and in serious discussion of flying stress, official documents in the flying Services speak not of fear but of lack of confidence. Doubtless there is here an underlying preference for meiosis, but there is more in the term than this. It implies the lack of a virtue rather than the presence of a vice. Confidence is a positive quality of inestimable value to the airman. Without it he can never achieve ontstanding success, and despite every effort he is likely to succumb sooner or later to the effects of flying stress. Lack of confidence is a major cause of flying accidents, operational failures, and psychological breakdown in air crews. What, then, is meant by confidence ? It is, I believe, compounded of, if not identical with, fearlessness, and will be the subject of my next lecture.

LECTURE II : THE FOUNDATIONS OF CONFIDENCE

1. Fearlessness

In this lecture I shall consider the nature of fearlessness, by which I mean a state of mind in which fear is absent under circumstances which would naturally be expected to arouse that emotion. I should make it clear at the outset that I distinguish fearlessness from courage. The latter is a state of mind in which fear is present, but is endured for the sake of attaining an object. Fearlessness, as the word implies, is a state in which there is no need for courage because fear does not exist. Fearlessness in relation to a particular stimulus pattern may be primary—meaning that no fear response has ever occurred; or secondary—meaning that the fear response was at one time present but has since been lost. Reverting to what has been said of the origin and grown of fear reactions in children, we may postulate causes for fearlessness of the first kind. First, certain trigger responses may be lacking owing to constitutional variation. Secondly, the process by which the original trigger responses normally develop, so that they respond to a wider range of stimulus patterns, may be interfered with. This process may be called learning, or in Pavlov's (1927) terms the development of conditioned responses, and may be interfered with in a number of ways. Broadly speaking in terms of conditioned response, we may distinguish between processes which depend upon variations in the efficiency of the cerebral cortex as analyser and those which result from variations in experience and training. For either of these reasons there may be failure to acquire those fear reactions which most people do acquire as the result of conditioning.

Thus there is a kind of fearlessness which is associated with lack of intelligence or imagination. Fearlessness of this origin may be a source of strength in time of danger, but carries with it a source of weakness. The same defect of brain or mind which prevents the acquisition of fear by conditioning or experience prevents the inhibition of fear by conditioning or experience. Thus the stupid man is fearless in the presence of remote or complex danger, but in the presence of immediate obstrusive dangers he is apt to be more overcome by fear for the moment than others of greater intelligence. Nevertheless, the man whose lack of imagination prevents anticipatory fear is thereby saved much stress.

That training and experience, or lack of experience, may affect the range of fear reactions is theoretically obvious and commonly observed. The factors involved are numerous and complex. Parental example and influence are clearly of great importance, and begin to operate so early that it must be very difficult to trace their origins. It is possible that an inhibitory process may in some instances anticipate the development of a positive conditioned response, or even, as Valentine (1942) suggests, that inhibition may be so well established on some other foundation that an unconditioned fear response destined to mature late never appears. The fearlessness of inexperience, due simply to lack of opportunity for the development of the ordinary range of conditioned fear responses, may be viewed separately. It is commonly observed in children, but comparatively rarely in adults, except under novel circumstances such as those of war. Then the noise of the approaching shell may leave the novice unmoved while at once exciting fear in the man who is aware from experience of its meaning. Unawareness of danger may also occur (even in the experienced person) from narrowing of the field of consciousness. A man may be so preoccupied with task or train of thought that there is no room for the idea of danger. The direction of such preoccupation has probably an emotional bias with inhibitory effect.

Apart from those varieties of fearlessness which depend upon the number and specificity of innate tendencies and the capacity and opportunity for acquiring conditioned reactions, both of a positive and of an inhibitory kind, it seems not impossible that in some individuals—to borrow a physiological expression—the threshold for fear is relatively high, as an innate quality. Such innate variation in the threshold of the fear response would be comparable with the variation in the affective response to painful stimuli observed by clinicians. The individual who is relatively insensitive to fear—using the word 'insensitive' with this restricted meaning—may be fearless under circumstances which would be expected to arouse fear in others, not for lack of intelligence, imagination, experience, or attention, but because the stimulus, whatever other effects it produces, fails to arouse the affective response. Such a man might at the extreme react to danger with flight but not feel fear, for the same kind of reason as a man insensitive to pain might throw away a match which he saw was burning his fingers without feeling pain.

Continuing with the same metaphor, fearlessness may be due to a low threshold for some affective response which can inhibit fear. Most fear-evoking situations are complex, and contain stimuli capable of evoking affects other than fear. Just as there are persons who are by nature especially sensitive to the evocation of fear, there are those in whom other kinds of affective response are relatively easily aroused, more intense, and of longer duration. Anger provides a good example, for many situations which are capable of provoking fear are also capable of provoking anger. If a person with a low threshold for anger be exposed to such a situation he may feel anger when another person would feel fear. Fear in these circumstances is inhibited.

2. Inhibition as a basis for fear

I have already used the word 'inhibition' more than once in connection with the absence of fear, and it becomes necessary at this juncture to discuss its meaning, for I believe that inhibition, besides playing some part in primary fearlessness, is the basis of all secondary fearlessness, the subject which I am next going to consider. The neuro-physiological concept of inhibition is best illustrated from the spinal or decerebrate animal. Here for a given muscle an afferent nerve may be found whose stimulation causes reflex contraction; another, whose stimulation diminishes or abolishes contraction if already present. Concurrent stimulation of excitatory afferent and inhibitory afferent reveals gradation of effect according to the intensity of the stimuli. A strong inhibitory stimulus will abolish, a weaker inhibitory stimulus will only diminish, the effect of the same excitatory stimulus. But, as Sherrington (1925) has said, there is more to be observed than this:

> "Stimulation of the inhibitory afferent when the excitatory reflex is not in operation may seem to produce no central effect. That this absence of central effect is, however, only semblance can be shown in several ways. Thus precurrent brief stimulation of the inhibitory afferent will lengthen the latency and diminish the result of a closely following stimulus of the excitatory afferent. Again, stimulation of the inhibitory afferent begun precurrently and continued concurrently with stimulation of the excitatory afferent can prevent altogether or diminish the reflex result of the latter."

The inhibitory effect under these conditions is not manifested directly, but indirectly by the absence of an expected contraction or an expected degree of contraction.

Contraction of a skeletal muscle depends upon the excitation of the motoneurone, and reflex contraction upon whether the flow of impulses peripherally aroused reaches the motoneurone to excite it. Sherrington conceives an interplay of central excitatory and central inhibitory activities at a point of confluence which he describes as "upstream" of the motoneurone. Whether the motoneurone is set into activity or not depends upon the balance here between central excitatory and central inhibitory states. The central inhibitory state is as much a positive phenomenon as the central excitatory state, and must itself be excited by appropriate impulses from without. When thus excited it safeguards the motoneurone partially or wholly from excitation. It seems that the hypotheses of central nervous function at the reflex level

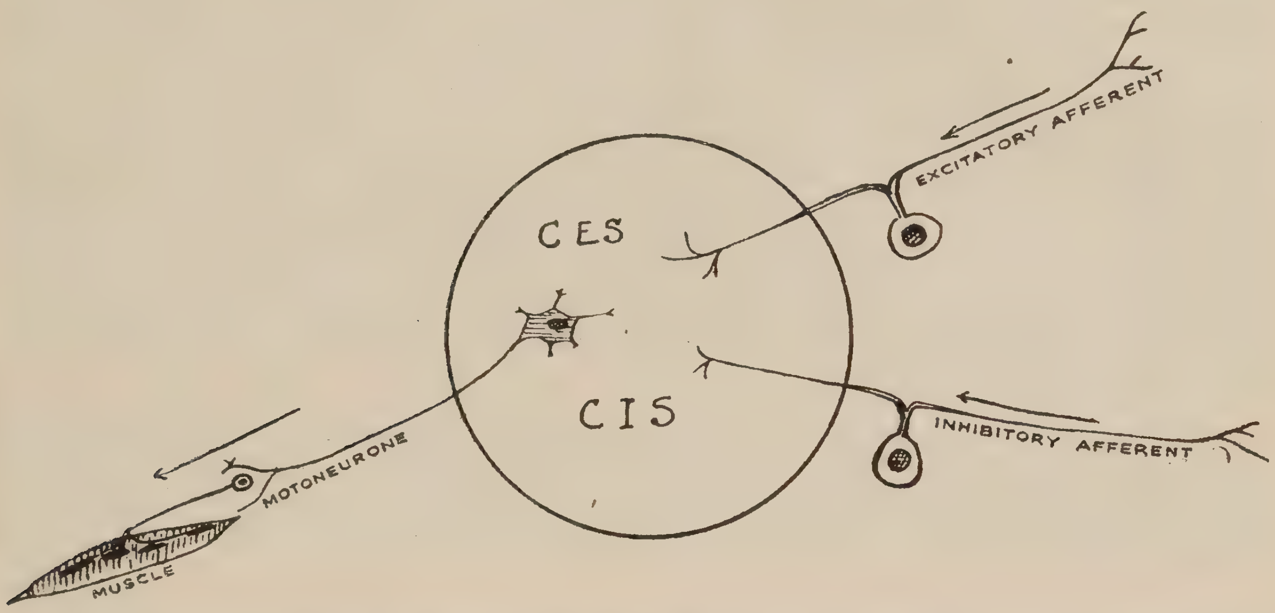

Diagram to illustrate the balance between excitation and inhibition in the reflex arc.
C.E.S. = Central excitatory state.
C.I.S. = Central inhibitory state.

which I have outlined may be applied with profit and without any great stretch of the imagination to physiological processes underlying the excitation of affect. We may suppose a central inhibitory state for a given affect (for example, fear), maintained by appropriate afferent stimuli, which would not be manifest at all except when stimulation of the excitatory afferent for this affect occurred. Then the inhibitory state would be revealed either by the absence of any affective response or by a response of unexpectedly small degree. We should then observe what we have described as fearlessness—the absence or relative absence of fear in relation to situations which might be expected to cause it.

The analogy of inhibition in a physiological sense has previously been employed by Rivers (1924) with particular reference to fear or 'wind up' in air crews during the last war. Rivers identified inhibition with the psycho-pathological concept of repression, and assumed that when a reaction to danger was unaccompanied by fear this emotion was present 'in the unconscious'. It is difficult to accept this concept for, as McCurdy (1925) remarks, "repressed" or "unconscious" affect is a contradiction in terms. An affect as such cannot have any existence unless it is conscious, because it is something that a person feels: it does not exist until it is felt. The view which I have taken differs in supposing inhibition to occur 'upstream' of the point of affective response. The central inhibitory state is revealed by the absence of affect, as in the motor system it is revealed by the absence of contraction in a given muscle. The affect might be said to be potentially present in so far as nervous impulses have been generated which would have excited the affect if they had not been blocked short—'upstream' of—the central point of excitation. But there has been no experience of affect, no registration of affect in 'the unconscious'.

There are two further points of reference for this analogy. An excitatory impulse if blocked by inhibition has no apparent effect, but this again is only semblance. It will have added an increment of excitation to the central excitatory state, thus cancelling an equal amount of the central inhibitory state. The balance in favour of inhibition is thus temporarily diminished, and a further excitatory impulse arriving during this time will meet with less resistance. This is in accord with the observation, which seems from introspective account to be true, that a frightening experience which does not in itself excite fear may have the result that for the time being fear is more easily excited by another stimulus of the same kind. There is, in fact, at the physiological or subconscious level central summation. The second point is that inhibition may provide one explanation for the absence of fear at the time of danger and its appearance later when the danger is past. The inhibitory forces may be various—anger, sense of duty, self-regard, or what Rivers called manipulative activity. These contribute to a central inhibitory state which occludes fear for the time being. As the situation develops the strength of these inhibiting stimuli becomes less. The occasion for anger is past, duty and self-regard are satisfied, the central balance alters, inhibition is weakened, and fear if still excited appears.

This attempt to describe certain aspects of fearlessness in physiological language is made not without realization of the dangers of over-simplification. Its excuse must be the desire to be explicit in applying the word ' inhibition ' to affective processes.

3. Pavlov's observations applied to fearlessness

I have already referred to the observations of Pavlov (1927) on the development of conditioned responses in connection with the growth of fear. His observations on inhibition are of equal value in understanding the growth of fearlessness. He showed that by various means it was possible, after a conditioned response had been established, to diminish or prevent the expected flow of saliva. The main variations of Pavlov's inhibitory responses, as will be remembered, are as follows. If a positive conditioned reflex (salivation) is established by the association of a stimulus—for example, the sound of a bell, with subsequent feeding—and then the bell is sounded on several occasions without feeding, salivation ceases to occur. The conditioned response is then said to have suffered extinction. The extinction of conditioned fear is a matter of common observation. A previously indifferent stimulus becomes by association a danger signal and by itself produces fear. One may take as one example the sound of a siren which has been followed by the fall of bombs. A conditioned fear response has now been established. Now, if the same stimulus is frequently repeated without subsequent bombing it ceases eventually to elicit fear. The conditioned fear response has been extinguished.

A second variety, called conditioned inhibition, is induced thus. A well-established conditioned stimulus is combined with a new (indifferent) stimulus, and the combination is repeated without subsequent feeding. The new combination soon becomes ineffective, though the original stimulus uncombined is still effective. Conditioned inhibition is an important factor for the acquisition of fearlessness in any occupation which ar first excites fear. The instructor makes use of it in training, combining with hazardous manoeuvre a trick or ritual: the man who carries a mascot to support his confidence is using the same method.

Differential inhibition is the name given to a third category of Pavlov's observations. A musical tone, for example, is used to establish a conditioned response. It is then found that a second, neighbouring tone will also excite the response (the phenomenon of irradiation). If subsequently the stimulus of the second tone is several times repeated without feeding, it not only fails to excite but becomes inhibitory. Examples of differential inhibition are easily found under conditions of war. For a man who has been exposed to shell-fire the whistle of a near-approaching shell becomes a conditioned stimulus for fear. By irradiation the whistle of any approaching shell, whether near or far, become effective to produce fear. With frequent repetition the sound of a shell which will be harmless ceases to excite fear, while that of a shell near enough to be dangerous is still effective. Fearlessness in relation to certain specific stimuli has thus been acquired by differential inhibition.

A fourth variety of inhibition described by Pavlov was external inhibition. This could be induced by an extraneous stimulus eliciting an unconditioned response other than salivation if this were timed to precede the conditioned stimulus. For example, an extraneous sound evoking what Pavlov called the orienting or " Where is it ? " response will thus inhibit a well-established conditioned response. The analogy between external inhibition and the inhibition of one affect by another is surely a close one. Psychologists have objected that Pavlov's observations might have been recorded equally well—they would say more accurately—in psychological terms. Pavlov (1941) replied that in such an interpretation the psychologist has adopted the conventional habit of thinking of the complicated activity of animals in terms of his own feelings and thoughts. The merit of Pavlov's observations is their objectivity.

One general observation made by Pavlov (1941) relevant to the present discussion was a relationship between the type of conditioned response most easily established and temperament. In one group of dogs positive conditioned responses were relatively easily established and well preserved, whereas inhibitory responses were less easily established and more readily lost. These animals he called specialists in excitation. In another group positive responses were established with greater difficulty and were less stable ; inhibitory responses were established with relative ease and were more stable. This group he called specialists in inhibition. He observed that his specialists in inhibition were invariably of a timid, cowardly disposition, and concluded that there was some inherent relationship between timidity and the preponderance of inhibitory function. As an example he gives the story of a dog born in the laboratory and always gently handled but always timid and shrinking. After some difficulty positive conditioned responses were established. Any extraneous stimulus, however, would abolish the positive responses, leaving the negative (inhibitory) responses. After the Leningrad flood, in which all the animals experienced the threat of drowning, this animal lost all positive responses. They were gradually restored when the original experimenter sat with the animal with the food in the experimental room. Then a trickle of water was allowed to flow under the door ; again all positive responses were lost, and had to be restored by the same means as before. This dog is described as a specialist in inhibition. Surely this interpretation is wrong. The animal was, in fact, a specialist in excitation for stimuli of a fear-evoking quality, and the excitation of fear inhibited other forms of response. This interpretation may be applied generally to the distinction between the excitatory and inhibitory types as observed under the restricted conditions of Pavlov's experiments. His specialist in excitation was a specialist of this type so far as the response to food is concerned. His specialist in inhibition was primarily a specialist in excitation so far as the fear response was concerned, and the excitation of the fear response caused inhibition of other responses.

4. Courage and confidence

In the acquisition of fearlessness it is evident that courage—persistence with the task despite fear—must play an important part. Persistence despite fear implies emotional conflict. During the exercise of courage awareness of the nature of the conflict and of the emotions involved on either side may be more or less clouded by self-deception. The presence of emotional conflict is, however, manifest by a feeling of tension from which courage is inseparable. In this respect it is essentially different from fearlessness. Courage is generally regarded as the quality most highly to be prized in the soldier, and rightly so, for his duty is bound to lead him where persistence despite fear is indispensable for success; but the soldier's courage is of even greater value in enabling him to acquire fearlessness. This is what we mean when we say that the brave man learns to conquer his fears. It is the fearlessness born of courage which is the greater prize than courage itself—the state of calm rather than the state of tension. What the soldier fears is the anguish of being afraid and having to exert a degree of courage which will absorb his attention and detract from his efficiency. A man of good morale therefore will endeavour by every means to acquire fearlessness, using his courage to this end.

From this discussion of fearlessness and courage I shall now return to the consideration of confidence and loss of confidence in flying personnel. Confidence may be regarded as being compounded of different kinds of fearlessness. Many of these are of the acquired variety (for flying is *ab initio* dangerous), and their acquisition therefore calls for courage. As also experiences of an exceptionally frightening nature are common in flying, and inseparable from operational flying, these various kinds of fearlessness, which are, so to speak, the stones of which confidence is built, are often exposed to stress and not infrequently dislodged: hence loss of confidence, more or less severe according to the number of stones dislodged and their key value in the structure. Courage is again necessary for repair. The amount of courage which a man needs to acquire and maintain confidence depends upon many factors. The most important of these are included in his pre-flying disposition and his flying experience. Let us try for a moment to imagine some of the fluctuations of confidence in an average pilot from the beginning of training to the completion of an operational tour in heavy bombers. We must suppose that he is by constitution neither exceptionally timid nor fearless. The first time he is air-borne he probably experiences slight fear. Awareness of the fact that flying is an offence against the law of gravity is, I have been told by very experienced airmen, seldom absent from the fringe of attention. Fear, however, is readily inhibited in the average person by the excitation of other affects, such as those involved in professional keenness and by the conditioning of experience. The first solo flight and the first performance of aerobatics again excite fear, which is again readily inhibited by the factors mentioned. In the course of training there are pretty certain to be other experiences of a fear-exciting kind—experiencing or witnessing crashes, death of friends, getting lost, narrow escapes of one kind and another. Most of these do excite fear, though sometimes it may be inhibited. Every time fear is excited the inhibitory state responsible for some kind of fearlessness is weakened. The exercise of courage is then called for. Experience then reconditions inhibition, and from further experience differential inhibition is developed. Meanwhile, however, there is a progressive loss of the fearlessness of inexperience; for the more flying a man has done the greater the number of things he knows which may go wrong, so that with experience the number of situations that are potentially fear-exciting increases, with a correspondingly greater demand upon inhibition for the preservation of confidence. The balance at rest, so to speak, between central excitory and central inhibitory states becomes more and more in favour of the former. For this reason, even under the relatively harmless conditions of civil aviation, when a man has flown long enough confidence tends to wane. This has been emphasized by Armstrong, and the neurosis which results from the effort to continue flying despite loss of confidence is, I think, what Armstrong (1939) has called aeroneurosis. Our hypothetical pilot, however, will not have flown long enough for this. When he reaches the operational training unit there are new dangers to be met arising from the length of trips and bad weather, and at the same time greater stress from fatigue. Now he embarks on his operational career to meet a whole series of fresh hazards. It is certain that these will test his courage, and possible that before the end of the tour the exercise of courage must be continuous, with inevitable tension and strain. So long, however, as he can make use of courage to conquer fears, and by this and other means can preserve his confidence, tension and strain will be diminished, efficiency will be augmented, and he will have courage in reserve to balance exceptional stress. What are the new factors which assail and support confidence in this phase of the airman's career ? On the one hand are all the hazards of flying over enemy territory to a target which he knows will be defended by flak, searchlights and night fighters, new dangers of weather involved in the length of trips, and the risk of bad visibility on return. There is also the effect of casualties. At first he is protected to some extent by the fearlessness of inexperience and by the inhibitory effect of curiosity upon fear. After the first few sorties this protection is lost. This is a critical point in the tour for confidence. As the tour goes on the more stable fearlessness of experience grows, but further experience adds to the number of conditioned fears which need to be inhibited if confidence is to be maintained. The strain of anticipation consequently increases, and the prolonged wait for a sortie cancelled at the last minute is almost as much of a strain as an actual trip. Fatigue, physical and occupational, is an additional factor weakening inhibition, and lack of sleep during periods of intense operational activity operates in the same direction. On the other side there are new factors which help to inhibit fear. High among these ranks squadron and crew morale.

Our pilot, then, having lost the fearlessness of inexperience, finds other sources of fearlessness to support his confidence, but towards the end of the tour a number of factors conspire to weaken the inhibition of fear. There is the increase in the number of conditioned fears resulting from the unpleasant experiences which he must by now have had ; there is the anticipation of relief from strain, and of holiday, which sometimes of a sudden makes life precious and fear insistent ; and there is the effect of cumulative fatigue. For all these reasons the structure of confidence tends to become weakened and the call for courage greater. I do not imply that at any time during the tour there has been no demand upon courage. On the contrary, distinguished men of great operational experience have told me that fear, especially before a trip, generally calls for conscious control ; but once the sortie has begun there is no fear in excess, and relatively little tension. There is, however, enough tension always, in most men, to cause that fatigue which we are all aware follows a prolonged effort to control emotion. There is reason, from clinical experience, to suppose that the effects of this kind of fatigue are cumulative. For example, a fighter pilot who had won the D.S.O. and D.F.C. and bar was observed by an experienced medical officer to be becoming tense and irritable by contrast with his normally good-tempered disposition. In this instance the suggestion that he needed a rest was disregarded ; but later he reported sick, confiding that for several months he had been aware of a conscious effort to control fear while on operational flights. The need for this effort gradually increased, and it was a greater strain to preserve his composure. He had good insight into his condition, arguing that real courage was the ability to overcome natural fear in the presence of danger, but had reached a point when he felt suddenly exhausted.

5. Lack of confidence

I have already referred briefly to the effect of a crash with injury in weakening fearlessness and undermining confidence. Several factors operate here besides the crash: there is the fact of being hurt; the opportunity for fear to increase with reflection; and the absence from flying, which by itself can impair confidence. The man who is able to fly again soon after a crash is better placed. Here is the self-revealed story of a fighter pilot who crashed and suffered a head injury and a fractured vertebra, with satisfactory recovery from both. He was sent back to duty apparently keen to fly, but after a short period returned to hospital with vague complaints of pain in his back. He was reassured, and returned to duty. A suspicion was entertained at the time that he had lost confidence, but was dismissed on his own denial; and there the story would have ended had he not unexpectedly written this letter to his physician nearly two years later :—

> " I can now fly and aerobat an aircraft in a way that fully satisfies me. In fact, I shall now make a confession to you. All the time I was in hospital I was scared stiff of flying. I definitely wanted to fly, but being in the air again just froze me with fright. I kept all this entirely to myself because I thought it would be put down to cowardice. Very stupid of me ! When the board eventually put me back on flying, I told them I wanted to fly, when they asked me, for the same reason. I eventually did about nine hours' flying, and most of it was a complete nightmare to me. I was simply scared stiff. But again I kept it all to myself. Then just when I was beginning to overcome my fears, and at the very time when I ought to have been made to fly, I was sent back to hospital. At that time I wondered whether I could continue on with flying when I left hospital, because it meant starting all over again. After that I did about 300 to 400 hours' flying before I really felt an inclination to confidence on just ordinary level flying. Now after 700 hours I have at last got full confidence back for aerobating. When I look back now and think of the agonies I went through it all seems rather amusing. However, the point now is that I am and feel perfectly fit and confident. My back is well, and that is that."

I will now present an example of another kind—that of a sergeant air gunner, a man of timid disposition in whom fear of flying was never inhibited. He eventually reported sick with dyspepsia, and was told by his medical officer that his symptoms were those of a neurosis, and of a kind which might be due to fear. Next day he wrote to his medical officer as follows :—

> " Sir,—As you know, I have during the last three or four months been suffering from, as I thought, some minor gastric disorder. This morning I was informed by you that my health is O.K. ; and the probable cause of my disorder was mental, or in other words some unconscious fear. After thinking very deeply on the subject for some hours, Sir, I have come to the conclusion that you are right, but only partly so, as you hadn't the whole of the evidence.
>
> You no doubt have the impression that this fear has only developed over the past month or so. That is not the case. It goes right back to the very first time I placed my foot in an aircraft. From the moment that craft left the ground I was in the grip of fear and subject to extreme nervous tension. This was not the usual feeling of uncertainty which I suppose everyone experiences on taking this step for the first time. It was real and concrete. Every moment, every bump or bank filled me, and still does, with breathless suspense, and the overwhelming desire to land and get away from it at all costs. My mental impressions to-day have not changed from those of my first flight. I still experience the same cold shivers and fears as I did then, only now more accentuated. If, Sir, these gastric pains are from the aforementioned trouble, I beg to point out that I have tried now for approximately twelve months to overcome the nauseating fear to which I am subject when flying, but, as events have borne out, so far unsuccessfully.
>
> The only conclusion to which I can arrive is that the trouble is not caused by temporary loss of nerve but by the gradual whittling down of the barrier I have consistently tried to erect between my temperamental equipment and the job to which I am assigned. No one has been more anxious than myself to overcome this complex, because not only has it been a severe blow to my personal pride, but also I have the same abhorrence as I suppose all persons have to being alluded to as ' yellow ' or some such designation by my acquaintances."

Although the relation of these stories has occupied some time, I could not without the aid of introspective accounts have illustrated the factors which influence the development of fear and fearlessness in flying personnel. It is to be observed that in none of these cases was there any lack of courage. One of the problems with which the Air Force doctor must be confronted from time to time is the distinction between lack of confidence and lack of courage. That there is such a distinction to be made I hope I have shown. How far a man must be expected to persist in the endeavour to conquer fear is a matter to be decided not by the doctor but by those who face the dangers of operational flying themselves. The principle is that which obtains for all combatant troops. There is, however, a special aspect of the problem for flying personnel, for the state of tension inseparable from the exercise of courage becomes sooner for them a drag upon efficiency. There may come a point for some when, whether they are to be judged medically sick or sound, they are no longer efficient. Whether they are to be disposed of then as brave men or as lacking in moral fibre must be left to the judgment of their peers. The severity of this judgment is a reflection of morale. Severity does not imply lack of sympathy. The distinguished leaders who have spoken to me of their own experiences have often dwelt upon the pain of fear in excess. They have also dwelt upon the happiness and satisfaction of fearlessness, with insight into the means by which in their own case it has been obtained. A fighter pilot who had previously flown light bombers in the Battle of France said that during this time he hardly ever saw targets or the effect of his bombs. After a while he was so frightened that he sweated every time he got into an aeroplane, and could not sleep. Later in Hurricanes in the Battle of Britain, he found—these are his own words: " Success in the game is the great incentive to subdue fear. Once you've shot down two or three the effect is terrific, and you'll go on till you're killed. It's love of the sport rather than sense of duty that makes you go on without minding how much you are shot up". This young officer was severely wounded in combat, but after his recovery went on to destroy many enemy aircraft, win several decorations, and command his squadron.

Here is a case in which the fighter job discovered an affective response which easily inhibited fear. It is an example of that chance matching of stimulus pattern with innate tendency upon which the foundations of confidence are sometimes built.

6. Conclusion

In this brief view of the human response to flying stress I have dwelt much on the psychological factors, because in the last war they were somewhat obscured by uncertainty about the effects of anoxia and are now more easily discerned. The analysis has led to a somewhat detailed discussion of fear and fearlessness, and to the conclusion that the emotional tension resulting from the prolonged exercise of courage is the most important element of stress. This does not exclude the presence of other important factors which deserve consideration. Skill fatigue in the pilot is one, and has been notably studied by Bartlett (1943), who has shown that loss of emotional control and abnormal behaviour may be prominent among its symptoms. Fatigue of vision and of hearing, the effects of acceleration and decompression, and even to-day under certain conditions anoxia, also play their part, and all may contribute to central nervous disorder. There are, therefore, effects of flying stress which the clinician will only see truly when he is guided by the psychologist and the physiologist, who in their turn may profit from clinical observation. In the study of the human response to flying stress collaboration of this kind is essential.

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CHAPTER IX

STATISTICAL SURVEY OF THE OCCURRENCE OF PSYCHOLOGICAL DISORDERS IN FLYING PERSONNEL IN THE SIX MONTHS FEBRUARY TO AUGUST, 1942

by

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Introduction

The classification of psychological disorders is exceptionally difficult. Between individual psychiatrists there may be discrepancies not only in the nomenclature of these disorders but in the causal factors recognised. Consequently when an attempt was made to determine the incidence and causes of psychological disorders in flying personnel it was found that the documents and case records accumulated before this investigation was begun presented such a medley of clinical terms and psychiatric opinions that it was impossible to subject them to statistical analysis. It was therefore decided to establish a method of case returns which should be acceptable to the greatest possible number of specialists and which would present in a manner as exact, consistent and objective as is possible in psychiatry all the information which seemed essential for this investigation. The work has been planned and the statistics handled in such a way as to present the problem purely as it affects flying personnel of the Royal Air Force, the medical and psychological terms having been simplified to this end. The co-operation of all neuro-psychiatric specialists was sought in reducing their observations to a common scale. That this was given loyally and efficiently is proved by the rarity with which we have encountered any discrepancy between the summaries of the same case returned by different observers. For the student in search of greater detail the full clinical records which constitute the foundations of this section of our report are available. Previous chapters deal with personal investigations into the factors contributing to and modifying the stress of flying and into the early symptoms of breakdown.

1. Material

Sources

The subjects of this report were 1,197 flying personnel referred to the Consultants in Neurology and the Specialists in Neuro-psychiatry at the Central Medical Establishment and at the operational neuro-psychiatric centres. All men who had been accepted for flying duties, whether they had begun flying or not, were included, so that men from the Air Crew Reception Centres and from all stages of training are included. It has not been possible, however, to include all flying personnel with psychological disorders in the scope of this investigation for there are some who are not referred to neuro-psychiatric specialists, who may be dealt with :—

(*a*) Directly by the squadron or station medical officers : many flying personnel who report sick or who are referred to the unit medical officer with complaints which have no physical foundation are dealt with without reference to a specialist. The cases treated in this way naturally include all the most promising and milder cases.

(*b*) By the general duty officers: many flying personnel found unsuitable for their duty on constitutional grounds during training are removed without medical advice; men found to be *lacking confidence* may be disposed of by the executive without the opinion of a neuro-psychiatric specialist.

(*c*) By other specialists: flying personnel with psychological illness have symptoms which mimic those of physical disease or which may be masked by them. They are referred to general physicians, otologists and ophthalmologists particularly. Only those subsequently referred by these specialists to the neuro-psychiatrist are included in this report.

Apart from closing these gaps in the investigation, the survey has been made as inclusive as possible.

2. Method

(a) Collection of material

A Central Registry of Psychological Disorders in Flying Personnel was established to which neuro-psychiatric specialists returned a card for every case of psychological disorder in air crew (specimen in Chapter VII, pp. 97–98). Except for the diagnosis, all details on the front of the card relate to exact particulars of the man's Service career. On the back the following observations are made :—

(i) Assessment of the predisposition to psychological disorders, determined clinically from past record and family history under the headings : nil, mild, severe.

(ii) Assessment of the degree of stress to which the man has been subjected under flying stress in relation to the average experience of flying personnel as nil, slight, moderate, severe, exceptional; and non-flying stress, including all personal and domestic factors associated with the illness, but not directly connected with flying, expressed as nil, mild, severe.

All data on these cards were transferred to a punch-card system for the purpose of statistical analysis.

(b) Presentation of material

The data were expressed, first, in absolute figures and then as percentages of total strengths. The total figures for the whole Service were divided into those for commands and into those for types of duty, air crew categories, commissioned and non-commissioned officers. Since the time of onset of the illness bears no constant relationship to the time of reporting to a neuro-psychiatric specialist the data obtained could not be exactly related to total command strengths at any one time. The nearest approximation seemed to obtain from the respective commands, average strengths for the six months under review. The figures have formed the basis for calculating percentages of strengths.

3. Survey of the whole Service

The total of 1,197 patients comprises all cases referred to neuro-psychiatrists at home in the six months February 3rd to August 3rd, 1942, and at Headquarters, Middle East, from February 2nd to June 27th, 1942. The 125 cases from the Middle East were therefore seen in 21 weeks as opposed to 26 weeks for the other 1,072 cases (at time of writing returns for the last five weeks from June 28th to August 3rd were not available). This means that the figure of 1,197 is less than the total incidence by 30 cases if the weekly rate of incidence in the Middle East is assumed to be constant. In relation to the annual incidence and the total number of cases this discrepancy is not of serious importance. Of possibly greater significance might be the distortion of the figures in smaller groups in which Middle East cases might form a considerable proportion. This possibility has been watched for and when it has appeared necessary the point will be brought out in referring to the tables.

TABLE I

Cases referred to the neuro-psychiatrist by the operational commands

Command	Total
Bomber	502
Fighter	108
Coastal	160
Flying Training	267
Army Co-operation	35
Middle East	125
Total	1,197

TABLE II

Referred cases analysed under types of duty

Duty	No.	Per-centage
Under training	352	28·7
Instructor	136	11·1
Bomber, day	86	7·0
Bomber, night	350	28·5
Fighter, day	106	8·6
Fighter, night	17	1·4
Coastal, General Reconnaissance ..	114	9·2
Coastal, bomber	16	1·3
Coastal, boats	5	0·4
Army Co-operation	34	2·8
Photographic Reconnaissance Unit	5	0·4
Air Sea Rescue	4	0·3
Ferry	3	0·2
Total	1,228*	99·9

* In 31 cases from the Middle East Command two duties were performed by the same patient during the illness.

It will be observed that nearly 30 per cent of the total cases arose during training. No such cases were returned from the Middle East and if this group is subtracted the incidence of cases in those under training amount to 33 per cent of those serving at home. The next highest figure of incidence is 28 per cent in night bombers. Instructors make a large contribution and the remainder were mainly divided between day fighters and bombers and coastal general reconnaissance. It is to be noted (Table XI) that 42 of 86 cases (49 per cent) among day bombers, and 38 of 106 cases (36 per cent) among day fighters were from the Middle East.

TABLE III

Referred cases analysed under air crew categories

Category	No.	Per-centage
Pilot	563	47·0
W.Op./A.G.	293	24·4
Observer	159	13·3
Air Gunner	156	13·0
Radio Observer	14	1·2
Engineer	12	1·0
Total	1,197	99·9

Approximately half of the cases occurred in pilots and a quarter in wireless operators/air gunners. The proportional significance of this, in relation to total strengths of aircrew categories is discussed later.

TABLE IV

Referred cases analysed under types of flying

Type of flying	No.	Per-centage
No flying	95	7·9
Non-operational flying	374	31·2
Under 100 operational hours ..	297	24·8
Over 100 operational hours ..	431	36·0
Total ..	1,197	99·9

Sixty-one per cent of the patients had been on operations before reaching a neuro-psychiatrist ; of these 59·3 per cent had completed more than 100 operational hours. Excluding Middle East Command, where the proportion of men on operations was at that time high, 57 per cent of the home cases had been on operations. Excluding Flying Training Command, 76 per cent of the patients had been engaged on operations.

TABLE V

Referred cases analysed under

Age

	No.	Age groups
	48	20
	569	20–24
	447	25–30
	133	30
Total	1,197	

Rank and civil status

	No.	Per-centage
Commissioned ..	348	29
Married	436	36

(a) Predisposition, flying stress and non-flying stress

As pointed out in the introduction, the grading of predisposition to psychological disorders and of environmental stress which has been attempted in this investigation is purely arbitrary, and can never, from the nature of the factors being assessed, be accurate in any one case. In such a large series of cases as these, observed in standard conditions by a group of observers whose criteria had been standardised the validity of the grading is considerable, and any statistically significant difference in the total figures obtained should have psychiatric significance. Thus, if one group shows a high rate of predisposition by the method adopted, the general tendency in the group may be accepted as being towards abnormal predisposition, although individual variations in predisposition in the group may be great.

TABLE VI

Referred cases analysed under flying stress, non-flying stress and predisposition

Flying stress			Non-flying stress			Predisposition		
Grading	No.	Percentage	Grading	No.	Percentage	Grading	No.	Percentage
Nil	459	38·3	Nil ..	708	59·1	Nil ..	386	32·3
Slight ..	318	26·5	Mild ..	440	36·7	Mild ..	622	51·9
Moderate ..	286	23·8	Severe ..	49	4·2	Severe ..	189	15·8
Severe ..	123	10·3						
Exceptional	11	1·0						
Totals ..	1,197	99·9		1,197	100·0		1,197	99·9

Three facts of importance emerge from the table :—

(i) Nearly two-thirds of the patients (64·8 per cent) had been subjected to no more than a slight degree of flying stress and over a third had been estimated to have had no stress.

(ii) Over a half (59·1 per cent) had not been subjected to non-flying stress.

(iii) Two-thirds (67·7 per cent) were considered to be predisposed to psychological disorder. This surprisingly high figure, like all other figures in this report, is based on the pooled opinions of all neuro-psychiatric specialists in Royal Air Force Operational Commands, and reflects directly upon the method of selection of air crews. The figure is seen to have even greater importance when it is considered that the criterion used to assess severe predisposition, present in 15·8 per cent, was that the predisposition was sufficiently marked, that had it been recognised at enlistment it would have warranted rejection for air crews.

Two hundred and eighty-two patients were considered to have had no stress of any sort. Twenty-one per cent of these had no evident predisposition, while 49 per cent were mildly and 30 per cent severely predisposed. Severe predisposition was thus twice as common in those without stress as in the total series of patients.

(b) Causes

In Table VII are tabulated only those factors which added to the load which the individuals had to carry. They are recorded without regard for the constitutional variation in the ability of the individual to carry that load, which is assessed under " Predisposition " Table in VI. The psychological causes of nervous breakdown are so varied, and depend to such an extent upon the particular way in which they affect the individual personality, that they have all, for the purpose of this report, been grouped under one heading. All that is attempted is to divide the purely psychological causes, such as fear, apprehension, worry or any form of conflict or psychological trauma, from the more evident physical causes, which are tabulated. The effects of altitude and cold were included, but in no case were these factors operative. It should be understood that airsickness here is considered only as a cause, and not an effect of the psychological disorder.

The total number of cases to which this table refers is 1,021, since in 176 of the patients no evidence of illness was found, and they were returned for Executive action with a full flying category.

TABLE VII

Total psychological disorder	Recorded causes of psychological disorders				
	Psychological	Exhaustion	Airsickness	Physical injury	Physical illness
1,021	1,017	19	21	158	99

A psychological cause for the illness was found to be present in all except four of the 1,021 patients. In 280, physical causes for the illness were found to be present in association with the psychological causes. In three others more than one physical cause was found. In every instance where physical injury, physical illness or airsickness were considered causes, psychological causes for the illness were also found. Exhaustion and airsickness played a part in only 1·8 and 2·0 per cent of cases respectively, while physical injury and physical illness together contributed to the illness in only 25 per cent of the cases.

(c) **Flying duties as a casual factor**

In only 129 cases (12·6 per cent) was the illness not considered to be related in any way to flying duties. Eighty per cent (103) of these 129 patients were under training, 65 per cent (84) being in Flying Training Command. Seventy-one (55 per cent) had done no flying and only 23 (17·8 per cent) had been on operations. The majority of these had completed a tour. An analysis of the degree of predisposition in this selected group of cases of neurosis not attributed to flying duties and of the stress to which they had been subjected is illuminating.

TABLE VIII

	Flying stress					Non-flying stress			Predisposition		
	Nil	Slight	Moderate	Severe	Exceptional	Nil	Mild	Severe	Nil	Mild	Severe
No. ..	112	12	5	—	—	70	42	17	23	61	45
Per cent ..	86·3	9·4	4·0	0	0	54·3	32·6	13·3	17·2	47·4	34·8

The degree of non-flying stress to which this group has been subjected is not very different from that in the main group (Table VI), but flying stress is almost absent, only 13·4 per cent having been subjected to even the milder degrees. It is apparent that those patients who break down as the result of personal worries or for no obvious cause are heavily predisposed, since 82·2 per cent show evidence of predisposition, and 35 per cent are severely predisposed. It will be noted that although 13·4 per cent of cases had been exposed to some degree of flying stress, this had not been considered a cause of the illness. In these individuals constitutional predisposition with exogenous factors unrelated to flying duties appear to have been more potent causes of breakdown than the stress of flying duties.

TABLE IX

Reaction type	No.	Per cent of 'medical' cases
Anxiety	789	77·2
Depression	107	10·7
Hysteria	117	11·5
Fatigue	59	5·8
Obsessional	21	1·3
Schizophrenic	13	1·0
Elation	3	0·2
Organic acute	1	0·1
Organic chronic	1	0·1
Lack confidence	176	—
Total	1,197	107·9*

* In 89 cases (7·4 per cent) more than one reaction type was recognised.

It will be seen that an anxiety state and a depressive illness, so often associated and sometimes inseparable, constitute 88 per cent of the medical diagnoses. Hysteria (11·5 per cent) was present alone in 70 cases. This condition, with a fatigue state (neurasthenia) and an obsessive-compulsive state constituted 18·6 per cent, the remaining diagnoses being rarely made (2·7 per cent). Of the 89 cases in which more than one reaction type was recognised, an anxiety state was present in 85 (95 per cent). The outstanding feature of this table is that the distribution of diagnoses does not differ greatly from that which would be obtained from any comparable group of patients with psychological illnesses. Members of crews who break down under stress, or as a result of predisposition appear to do so in the same manner as other people in different circumstances. The table shows that there is no necessity to postulate any psychological disorder peculiar to flying personnel. Attempts have been made elsewhere to do this (pages 18–21), such names as flying stress, aeroneurosis and acute pilots' fatigue having been coined, but no difficulty in describing the illness in accepted medical terminology was experienced by any of the specialists who contributed to this series of 1,197 cases.

(d) **Disposal**

Final disposals were only available upon 741 cases, and temporary disposals were given in 553 instances. In 94 of the latter a final disposal was given at a later interview. Until more is known about the ultimate disposal of the 553 still under observation, conclusions drawn from Table X should be made with reserve.

TABLE X

Categories	Disposals: Final	Disposals: temporary (total)	Disposals: temporary only
Full flying	202	—	—
Limited flying . .	41	266	227
Grounded	321	287	235
Invalided	10	—	—
Executive	167	—	—
Total . .	741	553	432*

*30 of these had two categories.

Sixty-three of the 121 patients in whom a final followed a temporary disposal returned to flying (55 full and 8 limited), but in 31 instances the patient was permanently removed from flying duties. In 53 the final disposal was the same as the temporary disposal. It is interesting to notice that 321 out of 331 patients (97 per cent) permanently grounded for non-physical reasons were considered fit to continue on ground duty in the Service. In 432 cases the final disposal is still unknown, and in 24 no disposal at all had been arranged. Of the 741 cases in whom a final disposal was known, 33 were removed from flying for medical reasons and 243 returned to flying, 41 with limitations. If the temporary and final figures are grouped, 47 per cent of the medical cases returned to flying duty. In appraising this result it must be remembered that many of the 235 who were temporarily grounded were in fact in hospital or on sick leave ; they would later receive a flying category.

4. Survey of commands

TABLE XI

Referred cases analysed under types of duty

Command	Total	Under training	Instructor	Fighter, day	Fighter, night	Bomber, day	Bomber, night	Coastal, general reconnaissance	Coastal, bomber	Army Co-operation	Photographic Reconnaissance Unit	Air-Sea Rescue	Ferry	Coastal boats
Bomber Ops. . .	348	—	—	—	—	44	304	—	—	—	—	—	—	—
Bomber O.T.U. . .	154	94	60	—	—	—	—	—	—	—	—	—	—	—
Bomber Command . .	502	94	60	—	—	44	304	—	—	—	—	—	—	—
Fighter Ops.	82	—	—	68	14	—	—	—	—	—	—	—	—	—
Fighter O.T.U. . .	26	15	11	—	—	—	—	—	—	—	—	—	—	—
Fighter Command . .	108	15	11	68	14	—	—	—	—	—	—	—	—	—
Coastal Ops.	125	—	—	—	—	—	—	103	16	—	2	1	—	3
Coastal O.T.U. . .	35	23	12	—	—	—	—	—	—	—	—	—	—	—
Coastal Command . .	160	23	12	—	—	—	—	103	16	—	2	1	—	3
Middle East	125	—	—	38	3	42	46	11	—	5	3	3	3	2
Flying Training . .	267	215	52	—	—	—	—	—	—	—	—	—	—	—
Army Co-op.	29	—	—	—	—	—	—	—	—	29	—	—	—	—
Army Co-op. O.T.U. . .	6	1	1	—	—	—	—	—	—	—	—	—	—	—
Army Co-op. Command	35	5	1	—	—	—	—	—	—	29	—	—	—	—
Total	1,197	352	136	106	17	86	350	114	16	34	5	4	3	5

The total number of duties in the Middle East Command is 31 more than the total cases. This is due to the performance of several forms of duty by some of the patients during the period of onset of the illness. For instance, a pilot may have been engaged upon day fighting and photographic reconnaissance. In the other commands the last duty performed before the illness is recorded.

Bearing in mind that actual strengths are not being taken into account, the more striking points in Table XI are :—

(i) That the largest contribution (42 per cent) is made by Bomber Command, the next being by Flying Training Command (22·3 per cent). Fighter, Coastal and Middle East Commands make contributions of the same order, about half that of Flying Training Command.

(ii) The greatest number of cases in any one category is that for air crew under training (353—30 per cent of the total and 33 per cent of those serving at home). Nearly two-thirds of these are from Flying Training Command, the remainder being from operational training units of the four operational commands at home. Air crew under training in Flying Training Command were in the following categories :—

TABLE XII

Flying Training Command	No.	Percentage
Pilots	114	53
Observers	34	16
Wireless Operators/Air Gunners	53	25
Air Gunners	13	6
Radio Observers	1	—
Total	215	100

The 137 flying personnel under training at O.T.Us. were in the following categories :

TABLE XIII

Under training at O.T.Us.	No.	Percentage
Pilots	53	38
Observers	30	22
Wireless Operators/Air Gunners	34	25
Air Gunners	19	14
Radio Observers	1	—
Total	137	100

(iii) The largest single group of operational air crews were those from night bombers (350—29·2 per cent). This number is further increased by the instructors at Bomber O.T.Us. and in Flying Training Command, 48 of whom had been on operations as night bombers before beginning all their duties as instructors. This brings the proportion of the total cases who had operated as night bombers to 33·3 per cent. These were in the following categories :—

TABLE XIV

In night bombers	No.	Per-centage
Pilots	125	31
Observers	54	14
Wireless Operators/Air Gunners	123	31
Air Gunners	93	23
Engineers	3	1
Total	398	100

Operational aircraft in Coastal Command contributed approximately the same number as day fighters (125 and 106), but whereas all the fighters were pilots, only 47 of those from crews of coastal aircraft were pilots. The relative significance of the figures in this table is discussed in relation to crew strengths in the final section of this report.

It will be observed from Table XV that in every command and O.T.U the pilots exceed any other air crew category. In Bomber and Coastal Commands the Wireless Operator/Air Gunners are nearly equal in number. This is discussed later in relation to total strengths.

TABLE XV

Command	Total	Crew categories					
		Pilot	Observer	Wireless Operator/ Air Gunner	Air Gunner	Radio Observer	Engineer
Bomber Ops.	348	105	46	109	81	—	7
Bomber O.T.U.	154	53	35	40	26	—	—
Bomber Command ..	502	158	81	149	107	—	7
Fighter Ops.	82	69	1	—	5	7	—
Fighter O.T.U.	26	23	—	—	—	3	—
Fighter Command ..	108	92	1	—	5	10	—
Coastal Ops.	125	47	14	47	12	1	4
Coastal O.T.U.	35	19	5	9	1	1	—
Coastal Command ..	160	66	19	56	13	2	4
Middle East	125	68	19	28	8	1	1
Flying Training	267	157	37	56	16	1	—
Army Co-op. Ops. ..	29	19	2	2	6	—	—
Army Co-op. O.T.U. ..	6	3	—	2	1	—	—
Army Co-op. Command ..	35	22	2	4	7	—	—
Total	1,197	563	159	293	156	14	12

It is evident from Table XVI that the stress of operations alone is not the sole factor in causing psychological breakdown, since a large number of cases occur in the O.T.U. as well as in Flying Training Command. In these training units 402 patients had not been on operations while only 86 (17·5 per cent) had. It is interesting to notice that in Bomber, Fighter, Coastal and Middle East Commands, 7·7, 10·5, 3·4 and 8·8 per cent respectively of flying personnel who broke down after reaching an operational squadron, did so before flying on operations. This group of people, who are unable to face the final reality of operational flying, has already been described in the report of visits to operational stations (pp. 33–36). Of these, 51 cases (79 per cent) were predisposed, compared with 453 (62 per cent) of those on operations, and 28 (55 per cent) were considered to be *lacking confidence.* Some indication of the factors concerned can be obtained by analysing the predisposition and degrees of stress in these different groups.

TABLE XVI

Command	Total	Percentages			
		No flying	Non-op. flying	Under 100 op. hours	Over 100 op. hours
Bomber ops.	348	—	8	60	33
Bomber O.T.U.	154	—	70	6	24
Bomber Command ..	502	—	27	43	30
Fighter ops.	82	—	12	52	38
Fighter O.T.U.	26	—	79	7	14
Fighter Command ..	108	—	28	41	32
Coastal ops.	125	—	3	40	57
Coastal O.T.U.	35	—	58	9	24
Coastal Command ..	160	—	18	33	50
Middle East	125	—	9	41	50
Flying Training	267	35	56	1	7
Army Co-op. ops. ..	29	—	45	35	21
Army Co-op. O.T.U. ..	6	—	100	—	—
Army Co-op. Command ..	35	—	54	29	17
Total	1,197	8	31	32	29

TABLE XVII

	Total	Percentages			
		No flying	Non-op. flying	Under 100 op. hours	Over 100 op. hours
Predisposition—					
Nil	386	14	26	30	46
Mild	622	45	54	56	48
Severe	189	42	20	14	6
Total	1,197	101	100	100	100
Non-flying stress—					
Nil	708	67	66	57	52
Mild	440	26	30	40	43
Severe	49	8	4	3	4
Total	1,197	101	100	100	99
Flying stress—					
Nil	459	100	63	25	11
Slight	318	—	25	37	24
Moderate	286	—	10	28	41
Severe	123	—	2	10	23
Exceptional	11	—	—	1	2
Total	1,197	100	100	101	101

Table XVII shows that there is an inverse relationship between the severity of predisposition and the degree of flying stress to which the patients have been subjected. There is a steady decrease in the proportion of those severely predisposed, with increase in the length of the flying career. On the other hand, there is an inverse relationship between the distribution of those without evident predisposition and those severely predisposed. The number of mildly predisposed individuals is similar in each group. As might be expected, the degree of flying stress varies directly with the flying experience, but the proportion of those subjected to mild non-flying stress rises steadily with an increase in the flying stress. It is difficult to explain this on the basis of a direct relationship between the two. The age distribution, the marriage rate, and the proportion commissioned is lower in Flying Training Command and the O.T.Us. than in the operational groups, and that these three factors are highest in Bomber and Coastal operational groups. It is probable that this results in a greater proportion of senior men being present in the operational groups. The likelihood of experiencing domestic marital and financial worries would be greater in these individuals by sheer weight of years and exposure to domestic stress.

TABLE XVIII

Command	Total	Percentage	
		Commissioned	Married
Bomber ops.	348	24	41
Bomber O.T.U.	154	26	46
Bomber Command	502	25	42
Fighter ops.	82	48	32
Fighter O.T.U.	26	39	43
Fighter Command	108	46	35
Coastal ops.	125	28	40
Coastal O.T.U.	35	56	41
Coastal Command	160	34	41
Middle East	125	42	27
Flying Training	267	20	26
Army Co-op. ops.	29	38	31
Army Co-op. O.T.U.	6	33	50
Army Co-op. Command ..	35	37	34
Total	1,197	29	36

The proportion of commissioned officers is higher in Fighter Command than in the others, presumably because the majority of the patients are pilots. In the operational fighter stations the proportion reaches 50 per cent. The average age is highest, and the proportion of married air crews highest, in Bomber Command, Coastal Command being very similar in this respect.

(*a*) **Predisposition and stress**

For greater facility the groups are now compared as percentages of the totals :—

TABLE XIX

Percentages of total in grades of

		Flying stress					Non-flying stress			Pre-disposition		
Command	Total	Nil	Slight	Moderate	Severe	Exceptional	Nil	Mild	Severe	Nil	Mild	Severe
Bomber Ops.	348	19	31	32	16	1	56	41	3	37	53	10
Bomber O.T.U. ..	154	49	16	24	9	1	70	30	1	24	62	15
Bomber Command ..	502	30	27	29	12	1	60	38	2	33	56	11
Fighter Ops.	82	23	32	32	10	1	68	27	2	35	49	13
Fighter O.T.U. ..	26	46	46	15	—	—	85	23	—	31	46	31
Fighter Command ..	108	29	35	28	7	1	72	26	2	34	48	18
Coastal Ops.	125	23	33	31	12	2	55	41	4	33	53	14
Coastal O.T.U. ..	35	56	23	21	—	—	59	33	9	21	56	24
Coastal Command ..	160	30	31	38	9	1	56	39	5	31	54	15
Middle East	125	20	31	29	18	2	43	51	7	51	46	4
Flying Training ..	267	75	16	6	2	—	64	30	6	22	48	30
Army Co-op. Ops. ..	29	35	35	28	4	—	45	45	10	38	55	7
Army Co-op. O.T.U. ..	6	17	67	17	—	—	67	33	—	33	50	17
Army Co-op. Command	35	31	40	26	3	—	49	43	9	37	54	8
Total ..	1,197	38	27	24	10	1	59	37	4	32	52	16

Interesting facts emerging are :—

(i) As would be expected, the degree of flying stress encountered in the O.T.Us. is much less than in the operational stations.

(ii) Complementary to this first point, predisposition to psychological disorders is invariably higher in the O.T.Us. than in the operational stations. It is slightly higher in Flying Training Command than in the O.T.Us. The lowering of the degree of predisposition as training advances and operations are reached is presumably due to the more heavily predisposed dropping out earlier in their flying career, without having been subjected to much stress. Those who remain are consequently a selected group with relatively less predisposition. The earlier in training the breakdown occurs, the more evident is the factor of predisposition. Thus the figures for severe predisposition in the O.T.Us. contrasted with operational sections of the commands are :—

Command	O.T.U.	Operational
Bomber	15	10
Fighter	31	13
Coastal	24	14
Army Co-operation	17	7
Flying Training	30	—

At the other extreme the Middle East command, composed at that time of seasoned personnel, had by far the lowest incidence of predisposition, half the cases showing none, and only 4 per cent being severely predisposed.

(iii) The proportion of patients subjected to each of the grades of flying stress in the operational stations of each of the four Commands, Bomber, Fighter, Coastal and Middle East, show a striking similarity. The assessment of the degree of stress of operational flying by the neuro-psychiatrists for the Central Registry therefore appears to have been consistent in spite of the varied duties of all the patients in these commands. There is no evidence of one form of stress peculiar to one duty. This being so, the degree of predisposition to psychological disorder of patients in each of these commands should be similar. This is in fact the case, except that in the Middle East Command where severe stress is rather more frequent than in the other commands, the absence of predisposition is higher.

(iv) Non-flying stress is slightly less common in the O.T.Us. than in the operational stations. It is least common in Fighter Command, which has the lowest marriage rate of the operational commands. It is highest in the Middle East Command, where the factor of expatriation is so potent. Compared with the degree of flying stress, which varies greatly between training and operational units, the degree of non-flying stress is relatively constant throughout the commands and stations.

(v) A study of the trends of the percentages of cases in Table XXI shows that there is a striking inverse relationship between the degree of flying stress and the amount of predisposition to psychological disorders in the different commands.

(vi) It follows that the likelihood of breakdown does not depend upon the degree of stress alone, since Table XIX shows that the number of cases with different degrees of flying stress are very similar in the operational sections throughout the commands, although the incidence of cases varies greatly (*see* Table XXX). It has been shown that predisposition varies roughly in inverse proportion to this stress, and in the training stations it is seen to be a major factor. It is probable that the amount of flying stress cannot be greatly reduced since it is an integral part of the life of operational air crews. Predisposition to psychological disorders can, on the other hand, be reduced by removal of the predisposed. Scrutiny of the figures for severe predisposition shows how profitable this may be, since, by the definition of severe predisposition (page 121) 189 (15·8 per cent) would have been eliminated if this predisposition were recognised in a single psychiatric interview on enlistment.

(*b*)

Causes

TABLE XX

Command	Total	Causes					
		Psycho-logical	Ex-haustion	Air-sickness	Physical injury	Physical illness	Mixed *
Bomber Ops.	348	315	7	7	55	32	97
Bomber O.T.U.	154	126	2	6	18	14	39
Bomber Command ..	502	441	9	13	73	46	136
Fighter Ops.	82	71	1	1	11	9	21
Fighter O.T.U.	26	23	—	—	6	—	6
Fighter Command	108	94	1	1	17	9	27
Coastal Ops.	125	106	4	3	18	9	32
Coastal O.T.U.	35	31	—	—	2	1	3
Coastal Command	160	137	4	3	20	10	35
Middle East	125	89	2	2	20	7	29
Flying Training	267	245	1	2	26	19	48
Army Co-ops.	29	24	—	—	3	7	10
Army Co-op. O.T.U. ..	6	5	—	—	2	2	3
Army Co-op. Command ..	35	29	—	—	5	9	13
Total	1,197	1,035	17	21	161	100	288

* Mixed refers to more than one cause being recognised in these cases (*see* pp. 125 and 126). The cases, therefore, appear in two or more of the columns.

Table XX confirms the observation made previously that psychological factors are the most important causes of breakdown in air crews. This observation holds for all commands. The other factors are evenly distributed throughout the commands and O.T.Us.

(*c*)

Reaction types

TABLE XXI

Command	Total	Reaction type										
		Elation	Anxiety	Depression	Fatigue	Hysteria	Obsessional	Schizo-phrenic	Organic, acute	Organic, chronic	Lack of confidence	Mixed*
Bomber Ops. ..	348	—	249	18	21	27	2	1	—	—	52	22
Bomber O.T.U. ..	154	—	101	13	9	12	5	1	1	1	28	17
Bomber Command ..	502	—	350	51	30	39	7	2	1	1	80	39
Fighter Ops.	82	1	60	8	5	2	2	—	—	—	10	4
Fighter O.T.U. ..	26	—	18	2	1	1	1	—	—	—	4	2
Fighter Command ..	108	1	78	10	6	3	3	—	—	—	14	6
Coastal Ops.	125	—	90	11	6	8	1	—	—	—	16	8
Coastal O.T.U. ..	35	—	21	5	4	4	—	—	—	—	4	3
Coastal Command ..	160	—	111	16	10	12	1	—	—	—	20	11
Middle East ..	125	1	72	20	2	9	—	—	—	—	35	14
Flying Training ..	267	1	154	26	11	52	9	11	—	—	21	18
Army Co-op. Ops. ..	29	—	20	3	—	1	1	—	—	—	6	1
Army Co-op. O.T.U. ..	6	—	4	1	—	1	—	—	—	—	6	—
Army Co-op. Command	35	1	24	4	1	2	1	—	—	—	6	1
Total	1,197	3	789	107	59	117	21	13	1	1	176	89

* Mixed indicates that more than one reaction type was present in these cases. They, therefore, are included in two or more of the columns.

The observation that there is nothing specific in the character of psychological disorders in air crews has support in the data in Table XXI, since the incidence of the different psychiatric reaction types is similar throughout the commands, operational and operational training units, in spite of the multifarious duties undertaken in all these units. The proportion of cases in whom the onset was not in any way determined by flying duties is, as might be expected, much higher in Flying Training Command than in the operational commands, and in the O.T.Us. than in the operational units.

TABLE XXII

Command	Total	Final disposal					Temporary disposal		
		Full flying	Limited flying	Grounded	Invalided	Executive	Limited flying	Grounded	Re-examined
Bomber Ops.	348	38	10	92	1	52	99	88	84
Bomber O.T.U.	154	24	6	40	1	24	24	29	25
Bomber Command	502	62	16	132	2	76	123	117	109
Fighter Ops.	82	14	7	11	—	9	14	31	14
Fighter O.T.U.	26	4	—	3	—	4	10	6	5
Fighter Command	108	18	7	14	—	13	24	37	19
Coastal Ops.	125	19	6	27	—	13	29	34	27
Coastal O.T.U.	35	7	1	11	1	3	4	7	7
Coastal Command	160	26	7	38	1	16	33	41	34
Middle East	125	46	5	6	—	29	49	53	52
Flying Training	267	42	4	124	5	29	33	32	35
Army Co-op. Ops.	29	7	2	4	1	4	4	6	7
Army Co-op. O.T.U. ..	6	1	—	3	1	—	—	1	—
Army Co-op. Command ..	35	8	2	7	2	4	4	7	7
Total	1,197	202	41	321	10	167	266	287	256

In Table XXII the column 'temporarily grounded' strikes an unjustifiably pessimistic note, for it includes all patients who were sent on sick leave prior to return to flying duty. It therefore has little practical significance. An interesting point arises in regard to the problem of predisposition, which has already been discussed. In Table XXII it will be seen that in Flying Training Command, 129 patients were removed from flying and only 51 returned to flying (15 of these were instructors). In the O.T.Us. 60 were removed and 43 returned to flying, and in the operational stations 142 were removed and 154 returned to flying. In Middle East Command particularly, 51 returned to flying and only 6 were grounded. From previous data presented this means that the greater the flying stress the higher the proportion of men returning to that stress after a psychological illness. In other words, predisposition is highest and the prognosis is worst in the safety of training units. This illustrates again the important part played by predisposition in determining these illnesses.

5. Lack of confidence

When the 176 flying personnel (15 per cent of the total) who were not considered to be medically ill are contrasted with the total series, several interesting points emerge. In the main there is similarity between the two groups and the differences are as follows :—

(i) In the group 'lacking confidence' the proportion of subjects with commissions is less than that in the large series—19 per cent compared with 29 per cent.

(ii) The marriage rate was 44 per cent compared with 36 per cent in the whole group. This slight difference may be a reflection of the observation that in some cases the wives persuade the man against flying intentionally or subconsciously.

(iii) Predisposition to psychological disorder was rather less evident in this group.

TABLE XXIII

Predisposition	Lack of confidence per cent	All cases per cent
Nil	45	32
Mild	52	51
Severe	3	15

Those mildly predisposed form just half of each group, but those severely predisposed are five times less common in the group 'lacking confidence.' Nevertheless, a high proportion of those considered medically fit at the time of examination and subsequently referred for executive action, were in some degree predisposed to psychological disorder.

In the group of those 'lacking in confidence,' however, there are half as many again who have no evidence of predisposition to psychological disorder. As in the total series this extra number probably represents those men who, although apparently normal in all respects, have for personal safety or gain decided that they will not fly again. From a clinical point of view these men stand out in contrast to the others, since there is less justification for their behaviour.

TABLE XXIV

Flying stress	Lack of confidence per cent	All cases per cent
Nil	39	38
Slight	36	27
Moderate	20	24
Severe	5	10
Exceptional	—	1

Table XXIV shows that a greater number of patients with a psychological illness have been subjected to the more severe degrees of flying stress than those who *lack confidence,* but an equal proportion of each group have been subjected to no stress at all. There is very little difference between the two groups, in the numbers who have experienced the lesser degrees of stress, in fact in this table also it is the similarity rather than the difference between the groups which is striking.

TABLE XXV

Non-flying stress	Lack of confidence per cent	All cases per cent
Nil	77	59
Mild	23	36
Severe	—	4

Table XXV shows that those who develop psychological disorders have been subjected to greater domestic and personal worries than have those lacking confidence, three-quarters of whom had no appreciable stress of this sort.

TABLE XXVI

Duties	Number of cases		Percentage lack of confidence
	Lack of confidence	All cases	
Flying training	21	267	7·9
O.T.Us.	36	221	16·2
Bomber operations	52	348	13·6
Fighter operations	10	82	12·2
Coastal operations	16	125	12·8
Middle East operations ..	35	125	28·0
Army Co-op. operations ..	6	29	20·6
Total	176	1,197	14·7

The relative number of cases lacking confidence is low in Flying Training Command and high in Middle East Command. It is interesting that in the former, flying stress is low and in the latter it is high. In the other Commands and O.T.Us. the proportion is similar to that of cases of psychological disorder.

(vii)

TABLE XXVII

Crew categories	Number of cases		Percentage lack of confidence
	Lack of confidence	All cases	
Pilot	76	563	13·4
W.Op./A.G.	60	293	20·5
Observer	18	154	11·2
Air Gunner	12	156	7·7
Radio Observer	—	14	—
Engineer	—	12	—
Total	176	1,197	14·7

The relative incidence of lack of confidence appears to be higher in wireless operator/air gunners than in pilots. The number of cases lacking confidence in observers and air gunners is probably not great enough to warrant definite conclusions.

(viii) TABLE XXVIII

Flying and operational hours	Number of cases		Percentage lack of confidence
	Lack of confidence	All cases	
No flying	7	95	7·4
No operations	55	374	14·7
Less than 100 op. hours ..	81	297	27·1
Over 100 op. hours ..	33	431	7·6
Total	176	1,197	14·7

It seems that lack of confidence is more likely to arise in the early stages of an operational tour than at any other time and as operational experience accumulates the individual is likely to continue in his duties until he develops a psychological illness rather than throw his hand in. This only will be a reflection of the higher morale of those reaching the later stage of their operational duty.

6. Relative incidence of flying stress

Owing to the different rates of expansion of the commands, and of the personnel in different duties and air crew categories in those commands, it has so far proved impossible to calculate an index by means of which accurate comparisons can be made. Some idea of the number of persons exposed to risk in each command, or in its component parts could be obtained if the monthly average strengths were known, as well as the monthly intake and output. This information could be used to calculate an index which would be roughly comparable from command to command. It is obvious that the usual figure of the annual incidence expressed as a percentage of the average strength has no value in this connection either in itself or for comparison. For instance, it was found that the cases coming to notice in the past six months first began to break down not only in these six months but during 1941 and even 1940. The large number of pilots involved consequently includes a large legacy from the previous two years, but the incidence in a new category such as radio observer is not similarly loaded. Any comparison of pilots and radio observers on the basis of a simple index would therefore be grossly misleading. Similarly, comparison of a fairly stable command with one which is rapidly expanding might lead to misinterpretation of the results.

All the information needed to calculate a reasonably accurate figure of incidence of psychological disorder in flying personnel in the different duties and categories in the commands is not at present available. For the purpose of this interim report an arbitrary index of the incidence has therefore been adopted to give a rough guide the relative incidence in commands, operational stations and O.T.Us., but it does not indicate the actual incidence. To this end the index for the whole service is taken as unity. The index is based upon the ratio of the cases to the average monthly strengths. The proportional incidence in commands, operational units and O.T.Us. is as follows :—

TABLE XXIX

Indices of incidence of neurosis in air crews

	Total	Operational units	O.T.U.
Royal Air Force	1·00	—	—
Bomber Command	1·85	2·77	1·02
Fighter Command	—	1·24	—
Coastal Command	0·93	1·82	0·44
Army Co-op. Command . .	1·15	—	—
Flying Training Command	0·41	—	—

The relative index of incidence in the larger air crew categories in operational stations and in Flying Training Command is shown in Table XXX. The figures for the newer and smaller categories are not large enough to be reliable.

TABLE XXX

Indices of incidence of neurosis in air crews at operational stations and Flying Training Command

	Bomber	Fighter	Coastal	Army Co-op.	Flying Training Command
All air crew . .	2·77	1·25	1·82	1·15	0·41
Pilots	3·03	1·67	2·20	1·10	0·39
Observers . .	2·01	—	1·10	—	0·31
W.Op./A.G. . .	2·74	—	1·72	—	0·33
Air Gunners . .	3·67	—	0·46	—	—

TABLE XXXI

Indices of incidence of neurosis in air crews at O.T.Us. and Flying Training Command.

Crew categories	Flying Training Command	Bomber Command	Coastal Command
All air crew	0·41	1·02	0·44
U.T. Pilot	0·39	0·54	
U.T. Observers	0·31	0·86	0·42
U.T. W.Op./A.G.	0·33	0·67	
U.T. Air Gunners	—	0·55	
Instructors	0·90	1·52	0·45

TABLE XXXII

Approximate relative index of incidence in duties

Duties	Index
Royal Air Force	1·00
Coastal G.R. and offensive	2·30
Bomber, day and night	2·27
Fighter, day	1·80
Army Co-op.	1·17
Fighter, night	1·07
P.R.U.	1·07
Instructing (Flying Training)	0·85
Under training (Flying Training)	0·41
Coastal boats	0·31
Air-Sea Rescue	0·31

For convenience the word incidence will mean the index already described, but it must be borne in mind that it is only absolutely comparable in commands, duties and crew categories if the rate of flow of flying personnel in these groups is similar. In Table XXIX it will be seen that Bomber Command has the highest incidence of psychological disorder in flying personnel; that for Flying Training Command is much lower than the others. The incidence in operational units is much higher than in O.T.Us., in Bomber and in Coastal Commands.

The incidence in operational stations in Bomber Command is over five times that in Flying Training Command. This confirms the evidence already presented of a direct relationship between the degree of flying stress encountered and the incidence of psychological disorder in air crews. When the crew categories of the commands are studied it is seen that in each the highest incidence is amongst the pilots except in Bomber Command where the incidence in pilots is second highest, being exceeded by air gunners. The highest incidence in all categories is in Bomber Command, with Coastal Command next and Fighter third. In Flying Training Command the highest incidence is in instructors, the majority (85 per cent) of whom are pilots, but there is no significant difference between the categories of those air crews under training, pilots being the same as the others. The incidence in these pilots under training is low. It seems, therefore, that the high incidence in pilots in operational units is due to some special stress to which they are subjected. Some of the factors which may contribute to this stress have been discussed on pages 47–54 and include the psychological strain of responsibility for the aircraft and its crew for the captain and the bodily fatigue of prolonged flights. To these must be added the possibility of central nervous fatigue following long continued and perhaps too frequently repeated skilled performance. It has been suggested that the high incidence in Bomber Command air gunners is due to lack of personnel selection on enrolment in this air crew category.

Although the incidence is low in personnel under training, it is higher in instructors, and whom it approaches the level of the operational crews. It was shown that 15 of 52 instructors who broke down in Flying Training Command had experienced the stress of operational flying before breakdown. This may be a factor in causing breakdown, but as the incidence is also high in the other instructors it appears that the nature of their duties, whether as the result of boredom, staleness, or anxiety, may increase the likelihood of psychological disorder. It is interesting that there is a uniform rate of breakdown in air crew under training, irrespective of their categories, suggesting that the nature of the basic duty, per se, does not contribute to the discrepancy between the incidences of breakdown in air crew categories in operational stations.

The incidence in different duties shows great variation. Coastal general reconnaissance and offensive duties have the same high incidence as bombing. Day fighting is slightly lower and is much greater than night flying. The distribution suggests that in the operational duties the incidence of psychological disorder is related to the amount of hazard involved.

7. SUMMARY

In a statistical survey of psychological disorders in flying personnel in the Royal Air Force in the period February 3rd to August 3rd, 1942, the cases have been analysed on the basis of commands, duties, air crew categories, flying hours and operational flying hours, time of onset, ages, proportion commissioned, psychiatric reaction types, causes, psychological stress related to flying and other factors, and of predisposition to neurotic illness. Finally the number of cases has been related to the average strengths in the commands, and the relative incidence determined, as far as possible, for commands, duties, air crew categories, and the proportion commissioned.

Points are worthy of note :—

(i) The number of cases of psychological disorder referred to neuro-psychiatrists in the six months was 1,197, 176 of these were considered to have no medical disability and were referred for executive disposal.

(ii) There were twice as many cases in Bomber Command (502) as in the next highest, Flying Training Command (267).

(iii) The duties contributing the greatest number of cases were air crews under training (30 per cent), and night bombing (29 per cent) Instructing was third (11 per cent).

(iv) Pilots made up nearly half the total (47 per cent), wireless operator—air gunners contributing a quarter (24 per cent).

(v) Nearly 40 per cent of the personnel had not reached operational duties, and 8 per cent had not flown at all.

(vi) An anxiety state or depression were present, alone or together, in 88 per cent of the cases. Hysteria was present in 12 per cent.

(vii) In all except 4 cases psychological causes were thought to have contributed to the illness. In 24 per cent physical causes were also present.

(viii) 42 per cent of those patients who had been given a final disposal returned to flying duties. 97 per cent of those permanently grounded were fit to continue in ground duties.

(ix) Nearly two-thirds of the patients (65 per cent) had been subjected either to slight flying stress or to no flying stress at all, and over a third were considered to have had no such stress. In 13 per cent the illness seems to have been unrelated to flying duties.

(x) Over a half (59 per cent) gave no history of contributory domestic or personal worries.

(xi) In two-thirds (67 per cent there was evidence of predisposition to neurotic illness. This was mild in 52 per cent and severe in 16 per cent. There was an inverse relationship between the incidence of severe predisposition and the flying stress to which the patients had been subjected. This latter was directly related to the amount of flying, and especially of operational flying, done by the patients. The incidence of severe disposition as high (42 per cent) in those who had not flown. In those who had begun their flying career the highest incidence of severe predisposition was in Flying Training Command (30 per cent), with a steady decrease with increasing experience. Thus, in each command it was higher in the O.T.Us. than in the operational units, reaching its lowest point (6 per cent) in those who had completed over 100 operational flying hours. The greater the predisposition the less is the amount of flying stress required to cause breakdown.

(xii) An approximate index of the incidence was calculated from the average monthly strengths. The severe limitations of this index, and the impossibility of determining the true incidence in view of the different rates of expansion of different commands, and of duties and categories in those commands, has been emphasised. On the basis of a hypothetical index of 1·00 for the whole Royal Air Force, the relative incidence of psychological disorder in air crew in different commands, duties and categories has been estimated. This was highest (2·27) in bomber operational units and lowest in air crew under training (0·41). In the operational commands it was invariably higher in the squadrons than in the O.T.Us., and in pilots higher than in any other air crew categories in the commands. In Flying Training Command, on the other hand, the index was roughly the same for each air crew category under training.

The duties with the highest incidences were Coastal G.R. and offensive duties (2·30) day and night bombing (2·27) and day fighting (1·80). The lowest were in Coastal boats and in the Air Sea Rescue Service (0·31).

CHAPTER X

CLINICAL AND STATISTICAL STUDY OF NEUROSIS PRECIPITATED BY FLYING DUTIES

by

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Introduction

In 2,200 of the 2,919 cases of psychological disorder in flying personnel seen by neuro-psychiatrists in the Royal Air Force in the year ending February 9th, 1943, the physician considered that the neurosis had arisen mainly from flying duties. This report is based upon an analysis of the data recorded for each of these cases by the neuro-psychiatric physicians who saw them, but it will take into account for purposes of comparison data recorded in the same way and during the same period, for cases of neurosis in air crews which were not attributed to flying duties. Reference will also be made to individual case histories and to observations made during visits of the two investigators to stations in the commands, reports upon which have already been presented (Chapters IV, V and VI). It is emphasized that the present report does not deal with the total incidence of neurosis in flying personnel during a year, but is confined to the problem of neurosis resulting from flying duties.

1. Method

The method of collection and sorting of data, with samples of the cards used and the instructions issued to the physicians who used them, is described in Chapters VII and IX. Briefly, every physician returned a card for each case of psychological disorder in flying personnel seen by him, to the Central Registry. On this card were recorded details of the patient's Service career, including flying hours, type of duty, the aircraft used, diagnosis, and an assessment of what in the physician's opinion were the most important factors in causation, with especial reference to the degree of stress to which the patient had been subjected in his flying, and in his life apart from flying, and to his constitutional liability to breakdown in the face of stress. Instructions upon definition and documentation were explicit. All the information, which was collected in as consistent a manner as possible, was transferred to a punch-card system and subsequently analysed. The sources of the material are described in Chapter IX, cases being unselected, and including all air crew categories and duties in the Royal Air Force. Altogether 2,919 flying personnel were referred to neuro-psychiatrists for a psychiatric opinion during the year, and were divided as follows :—

	Cases
Neurosis arising mainly from flying duties	2,200
Neurosis not directly caused by flying duties	303
No neurosis, but lacking in confidence	416
Total	2,919

The decision whether or not a neurosis has been caused mainly by flying duties has, of course, to be made by the physician on the basis of his interview, and it depends upon his clinical judgment. In most cases the decision is a simple one, but all cards were scrutinised at the Central Registry, doubtful cases being referred back for reconsideration. The physicians were instructed to include in this group all neuroses resulting from experiences peculiar to air crews, and to list these experiences in each case. The instructions stated that these experiences

> 'may include, for example, anticipation of flying before flying has begun, witnessing unpleasant incidents, death of friends: actual experience of mishaps, shaky-dos, crashes, flak, immersion, exhaustion, altitude effects, cold, air sickness, physical injury. Effects of physical injury will, however, only be included if the resulting psychological disorder is not purely of the organic type. For example, a man suffering a head injury in a crash may be confused; a man with an infected wound may become delirious. The symptoms in such cases, though they are symptoms of psychological disorder and have arisen from flying duties, are of the organic reaction type, therefore no card need be returned. A man who has suffered injury to the head, however, or any other part of the body in a crash may develop a state of anxiety because he has been hurt and fears being hurt again. This is psychological disorder not of the organic type, and a card will be required.'

Although this report is concerned with the group of cases arising mainly from flying duties the other two groups will be referred to in order to illustrate points in the arguments presented. These are based on figures giving the actual number of cases of neurosis; the incidence of neurosis per 100 man-years.

The conception *man-year* has been adopted on the advice of Professor A. Bradford Hill, because the conditions in the commands vary so much that a comparison of incidence in terms of average strength may be misleading. This is so because the rate of intake and the rate of outflow from commands, whether due to casualties or postings, varies so greatly that the actual number of men who pass through the command may have little relationship to the average strength. For example, using hypothetical figures, suppose that:—

> 1,000 cases occur in Bomber Command with an average strength of 10,000 men and a flow of 50,000 men through the command in the year, while 500 cases occur in Fighter Command with an average strength of 5,000 and a flow of 7,500 men in the year. The incidence would be 10 per cent of the average strength in each case, but it would be 2·0 per cent of the total men in the first and 6·6 per cent in the second. As the average time a man stayed in Bomber Command would be $\frac{10,000}{50,000} \times 12 = 2 \cdot 4$ months and in Fighter Command $\frac{5,000}{7,500} \times 12 = 8 \cdot 0$ months, the time available for each man to break down in Bomber Command being only about a third of that in Fighter Command, very many more men have been exposed to the risk of breaking down in Bomber Command than in Fighter Command in the same year. If *number of individuals* and *duration of stay* are combined in the conception of *man-years*, we have a unit which covers both average strength and rate of flow and provides a basis for comparison of the relative incidence in commands, duties and crew categories, with varying strengths and times of stay of the personnel. A hundred man-years may be made up by a hundred men staying in a command for a year, or by 400 only staying for an average of 3 months, but a moment's thought shows that if all other factors are equal the number of illnesses occurring in the two groups would be equal, since the 100 men were exposed to the chance of illness for four times as long as the 400.

The simple calculation in the previous paragraph shows that both the average strength and the rate of flow through the command are used to calculate the number of man-years. The incidence in man-years has been calculated from the number of cases, the strengths at the beginning of each quarter, and the total intake in each quarter during the year of inquiry. From these data the statement that the incidence of neurosis in X men with an average stay in the command of Y months was Z per 100 man-years may be completed.

It was subsequently found that incidence expressed as per cent man-years was roughly the same as if it had been expressed as per cent average strength. For comparison, however, per cent man-years is more reliable.

2. Incidence

TABLE I

Distribution in crew categories resulting from flying duties in a year

Category	No.	Per cent of total
Pilot	1,016	46 ⎫
W.O.P./A.G.	455	21 ⎬ 96
Air Gunner	319	15 ⎪
Navigator	311	14 ⎭
Flight Engineer	30	1·4
Navigator, R.	21	1·0
Bomb Aimer	19	0·9
Navigator, W.	16	0·7
P.N.B.	10	0·5
Navigator, B.W., etc.	3	0·1
Total	2,200	

This shows that nearly half of all cases arise in pilots and that 96 per cent were confined to pilots, wireless operators, airgunners and navigators. The other eight crew categories together only contributed 99 cases (4 per cent), so they will be grouped together and the discussion limited to the first four categories. (*See also* Fig. 1, page 143.)

TABLE II

Percentage of cases analysed in crew categories

Command	Total	Pilot	Navigator	WOP/AG	A/G	Other categories
Bomber	942	29	18	26	22	5
Middle East	299	59	10	17	12	2
Coastal	271	44	12	31	9	4
Fighter	197	84	3	1	8	4
Army Co-operation	46	67	9	11	11	2
Flying Training	445	55	17	15	8	—
Total	2,200	46	14	21	15	4

Table II shows that in all commands except Bomber, pilots made up the bulk of the cases and that they represented 84 per cent in Fighter Command. In Bomber Command the distribution of cases was much more uniform, and pilots made up just under 30 per cent of the total.

TABLE III

Incidence in crew categories as a percentage of man-years

Category	Incidence per 100 man-years
Air Gunner	5·2
W.Op./A.G.	4·4
Navigator	2·8
Pilot	2·8
Other categories	2·0
All categories	3·2

It is apparent from Table III that the high percentages of pilots shown in Tables I and II gives a false impression of the relative incidence which is actually lower in this category than among air gunners and wireless operators.

As conditions to which air crew under training are subjected in Flying Training Command are quite different from those found in the operational Commands, and as air crew under training are so numerous as to affect the total incidence materially, it is best to consider the position in Flying Training Command separately, as in Table IV.

FIG. I

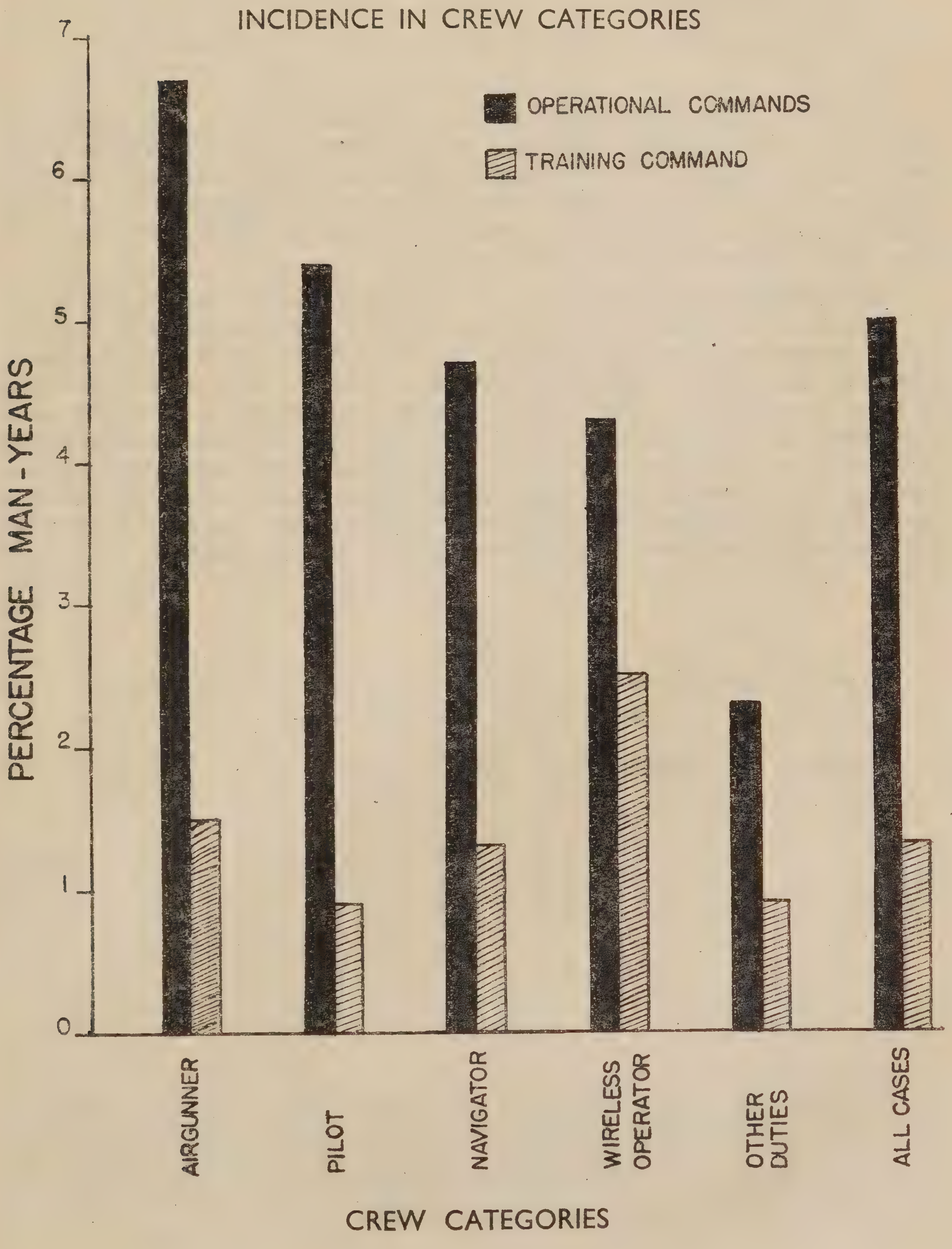


TABLE IV

Incidence in air crew categories per 100 man-years in Flying Training Command

Category	Operational Commands (per 100 man-years)	Flying Training Command
Air Gunner	6·7	1·5
Pilot	5·4	0·9
Navigator	4·7	1·3
W.Op./A.G.	4·3	1·4
Other categories	2·3	0·9
All categories	5·0	1·3

This table shows that in the operational commands, *i.e.*, the Royal Air Force apart from Training Command, the incidence of neurosis attributed to flying duties is higher in air gunners than in any other category, and that pilots, in whom it is next highest, have an incidence slightly above the mean, which is exactly 5 per 100 man-years. It should be remembered that this refers only to neurosis resulting from flying.

The *distribution* of cases in air crew categories in each command is shown in Table II, the *incidence* in air crew categories in the Commands in Table V. As the categories Bomb Aimer, Flight Engineer, Navigator R. and Navigator B.W. had only recently been instituted, the number of man-years represented by them as well as the total number of cases contributed by them (99) is so small that the incidence figures are unreliable. They have therefore been excluded from this table. When the figures for pilots, navigator, wireless operator and air gunner are compared, it is seen that in every operational command, the breakdown rate is greatest in air gunners and is next greatest in pilots, while it is lowest for navigators and wireless operators.

TABLE V

Incidence (per 100 man-years) in commands analysed in air crew categories

Category	Bomber	Middle East	Fighter	Coastal	Army Co-op.	Flying Training	R.A.F.
Air Gunner	8·0	7·0	5·8	5·5	5·3	1·5	5·2
Pilot	6·8	5·8	4·9	5·0	3·6	0·9	2·8
Navigator	5·8	2·6	2·3*	2·7	2·4	1·3	2·8
W.Op./A.G.	5·5	3·6	—	2·9	2·4	1·4	4·4
Command	6·5	4·8	4·0	3·9	3·5	1·3	3·2

* Navigator Radio

The breakdown rate for all air crew categories is higher in Bomber Command and is lower in Army Co-op. Command than in any other operational command. The low figures for Training Command are in striking contrast to those for the operational commands. A discussion of the causes of these varying incidences will be deferred until further facts are presented.

(a) **Duties**

The number of duties in Table VI is greater than the number of cases because in 216 instances, or 10 per cent of the total, the patient performed two duties before he broke down, both of which were considered causal and both recorded.

TABLE VI

Distribution of the cases analysed under duties

Duties	No. of cases	Percentage of duties
Bomber, night	791	33
Under training	584	24
Instructor	264	11
Fighter, day	237	10
Coastal, General Reconnaissance . .	170	7
Bomber, day	158	7
Fighter, night	56	2
Army Co-operation	37	2
Coastal boats	33	1
Coastal strikes	29	1
Ferrying	14	0·4
Photographic Reconnaissance Unit	9	0·3
Air Sea Rescue	5	0·2
Test pilot	3	0·1
Other duties	26	1·1
Total cases	2,200	100

In operational duties the largest contributions are made by night bombers, day fighters, coastal central reconnaissance and day bombers, but it is obvious that the size of these figures depends largely upon the populations at risk. The contribution from training units, made up by the men under training and instruction, is 35 per cent of the total duties. More detailed analysis shows that the proportion contributed by the O.T.Us. is rather smaller and ranges from 21 to 31 per cent throughout the commands.

TABLE VII

Incidence in duties in operational units of commands
(per cent man-years)

Command	Day Fighter	Night Fighter	Day Bomber	Night Bomber	Coastal	Army Co-operation
Bomber	—	—	11·2	12·1	—	—
Middle East	10·4	—	8·9	8·8	2·4	—
Fighter	6·0	3·4	—	—	—	—
Coastal	—	—	—	—	3·9	—
Army Co-operation	—	—	—	—	—	5·4

Table VII shows the *incidence* per cent of man-years in the principal operational duties in each of the commands. Those duties which had an insignificant representation in the command and consequently gave an unreliable figure of incidence have not been included. It is instructive to compare the figures with that for all the operational commands, namely 5 per cent. It will be seen that in the conditions which existed in 1943, the incidence per cent of man-years in operational units of Bomber Command was higher than that for any other operational duties, and that night bombing produced nearly two and a half times the neurotic illness experienced on an average in all operational units, twice that of day fighting, and three times that of Coastal operational duties. The low breakdown rate in night fighters compared with day fighters is striking, but the actiological significance of these differences will be discussed in detail later.

A comparison between the incidence of neuroses attributed to flying duties for the whole Command and for the operational and training sections is shown in Table VIII. In all Commands this breakdown rate is highest in operations, and it is consistently lowest for personnel under training, being just 1 per 1,00 man-years for air crew under training in Flying Training Command—(Figure 2).

FIG. 2

INCIDENCE IN COMMANDS

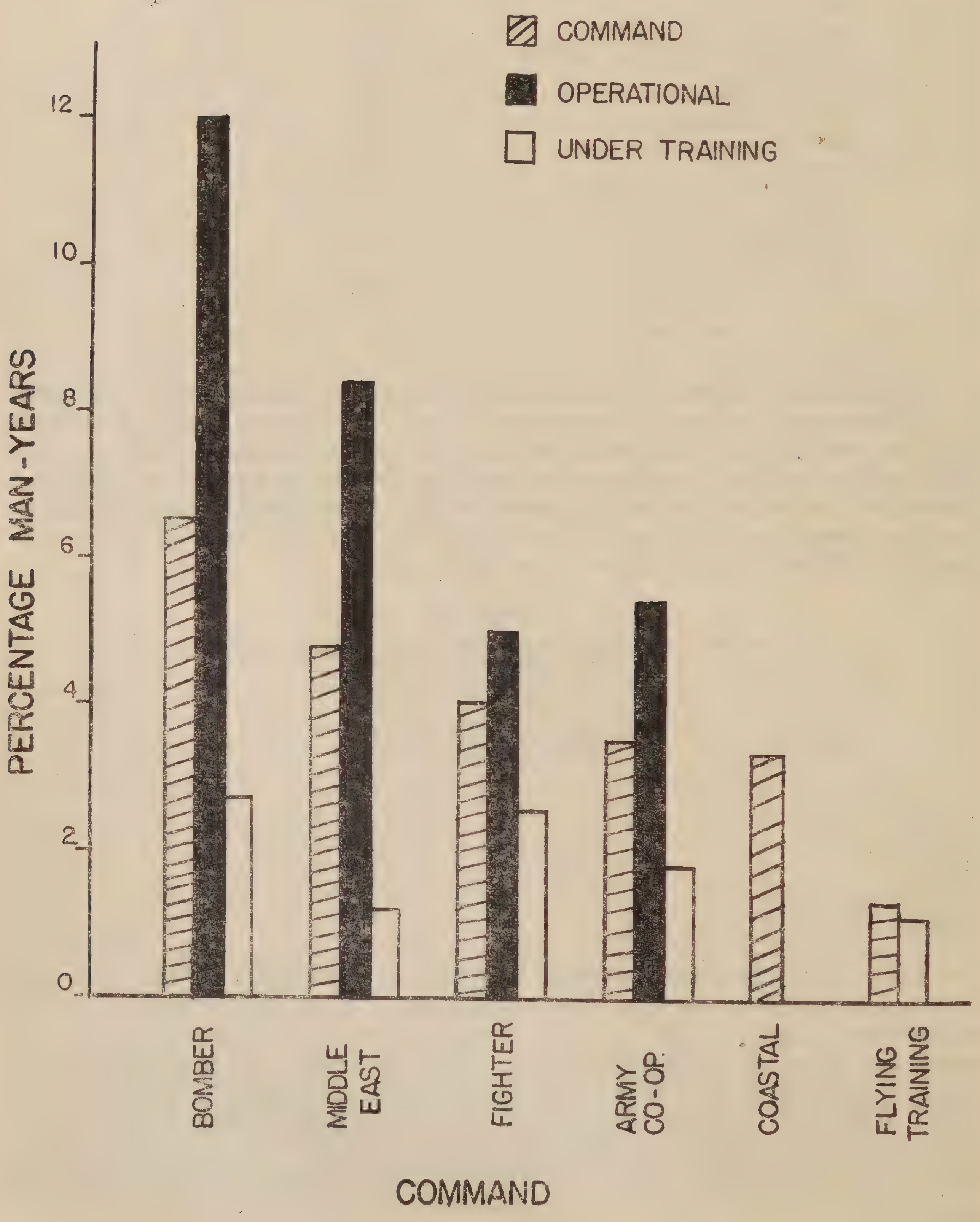


TABLE VIII

Comparison of incidence in the whole command with those in the operational and training sections (per cent man-years)

Command	Whole command	On operations	Under training
Bomber	6·5	12·0	2·7
Middle East	4·8	8·4	1·2
Fighter	4·0	5·0	2·5
Army Co-operation ..	3·5	5·4	1·8
Coastal	3·9	—	—
Flying Training	1·3	—	1·1

It is of interest to compare in Table IX the distribution of neurosis occurring in flying personnel but not attributed to flying duties. This shows that nearly three-quarters of these cases occurred in men who were under training. Samples of the *incidence* of the neuroses which were apparently unrelated to flying are shown in Table X.

TABLE IX

Neuroses apparently unrelated to flying duties in commands (per cent of total cases)

Command	Total cases	Under training	Instruct.	Day Fighter	Night Fighter	Day Bomber	Night Bomber	Coastal	Other duties
Middle East ..	29	10	7	34	—	14	24	7	6
Bomber	30	33	27	—	—	3	53	—	3
Fighter	19	32	16	21	32	—	—	—	5
Coastal	13	31	—	—	—	—	—	62	8
Army Co-operation	7	14	—	—	—	—	—	—	100
Flying Training ..	205	93	5	0·5	—	—	—	—	2
Total ..	303	71	8	5	2	1·7	8	3	4

TABLE X

Incidence of neuroses unrelated to flying

Personnel	Incidence (per cent man-years)
Under training in Training Command	0·64
All under training	0·50
All operations	0·30
Bomber operatious	0·27

This table shows that the actual incidence of neurosis considered by the physician to be unrelated to flying duties tends to diminish with increasing flying experience. If the opinion of the physician is reliable it may be that preoccupation with the hazards of operational flying may in some way protect the individual from the effect of worries unrelated to flying.

(b) Marriage

TABLE XI

Comparison of the marriage rate in the groups related and unrelated to flying duties (per cent of cases)

Command	Neurosis and flying duties	
	Related	Unrelated
Middle East	29	55
Bomber	40	53
Fighter	35	57
Flying Training	36	23

Coastal and Army Co-operation commands were not included in Table XI as too few cases were available in the second column. It is apparent that in the operational commands marriage plays a more important part in the neuroses unrelated to flying duties than in those related to them, while the reverse obtains in Flying Training Command. The explanation which occurs to us is that in the squadron the man is not only for the time being cut off from his family life, but he is so imbued with the squadron and crew spirit and is so preoccupied with the job in hand that the anxieties and cares of his private life are relatively unimportant. Thus, during his period of greatest hazard he is protected from many of the stress factors of civil life.

(c) Flying hours and operational experience

TABLE XII

Operational and non-operational flying experience before cases reported sick

Category	Total	Flying experience (per cent of total cases)			
		None	No ops.	Under 100 operational hours	Over 100 operational hours
Pilot	1,016	4	32	28	35
Navigator	311	7	42	26	25
W.Op./A.G.	455	5	23	33	39
Air Gunner	319	2	26	39	33
Other categories	99	11	32	41	15
Total	2,200	5	31	31	33

It shows that neuroses caused by flying duties are equally distributed between men who have not flown on operations, who have started their tour, and who have had considerable experience of operations. This is not to say that the experience of operations does not play a profound part in causing the neurosis, for it must be remembered that the population of men under training is much greater than that on operations, and the casualties in the first 100 hours of operations have materially reduced the number surviving to experience the risk of breakdown in the second part of the tour. This is shown by the figures of incidence in Table VIII which indicate that in each command the proportion of men who break down while on operations is invariably higher in those who are under training in the Command, and much higher than in Flying Training Command. Thus, although each of these three stages of duty contributes about the same number of cases, the incidence rises steadily and steeply as experience of operational flying increases.

Although the proportion of navigators in healthy air crews is the same under training in Flying Training Command, at the O.T.Us. and on operations, half the cases of psychological disorder which occur among navigators arise before reaching operations, compared with a third or less in pilots, wireless operators, and air gunners. This difference is possibly related to a special form of stress to which navigators are subjected which is discussed on page 151.

Table XIII shows the time of breakdown in relation to flying and operational experience in each command. Bomber and Fighter Command, in which the estimated stress of operations as indicated by the operational limit in hours is rather similar, show almost identical proportions of cases both early and late in the operational tour. In Coastal Command, on the other hand, in which the operational limit for the majority of duties is two or three times as long as in the other two commands, the peak period for breakdown occurs late in the tour.

TABLE XIII

Time of breakdown in relation to flying and operational experience in commands (percentage of cases)

Command	Total	None	No ops.	Under 100 operational hours	Over 100 operational hours
Bomber	942	—	25	41	35
Fighter	197	—	20	42	37
Coastal	271	—	15	30	55
Middle East	299	—	10	38	53
Army Co-operation	46	—	59	26	15
Flying Training	445	23	67	3	6

TABLE XIV

Comparison of average time of onset of neuroses caused by flying duties in Bomber Command, with the time when those lacking in confidence ceased flying

Group of cases	No.	Flying experience (per cent of cases)		
		Operational hours		
		None	Under 100	Over 100
Neuroses due to flying ..	942	25	41	35
Lack of confidence ..	156	27	56	17

The point which emerges from this comparison is that when a man is unable to continue flying through fear, without a neurosis, he is most likely to report his fear after a little operational experience.

3. Stress and predisposition to breakdown

In order to assess the factors which are responsible for the relationship of operational experience to the likelihood of breakdown, the part played by the stress of flying, by other psychological factors, and by the individual's own liability to breakdown should be investigated. In Table XV (*a*), (*b*), and (*c*) these three groups of factors are considered for the 2,200 cases of neuroses due to flying duties. In these tables, *flying stress* means the amount of hazard encountered, the hazard being measured against the usual expectation of danger in wartime flying. It was shown on page 129 that the assessments, which fell into five grades : nil, slight, moderate, severe, exceptional, showed great uniformity and that it was quite possible with experience to make a practical measure of this stress, irrespective of the duty involved. *Non-flying stress* refers to all the other types of stress, domestic, monetary and personal, to which the patient has been subjected, and *predisposition* which has already been the subject of other reports by Gillespie, Symonds, Williams and others, is the estimated liability to breakdown while serving as a member of an air crew.

TABLE XV(a)

Category	No.	Flying stress (per cent)				
		Nil	Slight	Moderate	Severe	Exceptional
Pilot	1,016	27	33	28	12	1
Navigator ..	311	42	25	22	11	1
W.Op.	455	27	26	29	17	1
Air Gunner ..	319	27	27	30	14	2
Others	99	46	29	18	4	2
Total	2,200	30	29	27	13	1

TABLE XV(b)

Category	No.	Non-flying stress (per cent)		
		Nil	Mild	Severe
Pilot	1,016	63	34	3
Navigator	311	68	29	3
W.Op.	455	60	37	3
Air Gunner	319	66	31	3
Others	99	64	31	4
Total	2,200	63	34	3

TABLE XV(c)

Category	No.	Pre-disposition (per cent)		
		Nil	Mild	Severe
Pilot	1,016	32	52	16
Navigator	311	25	54	21
W.Op.	455	25	55	21
Air Gunner	319	22	55	23
Others	99	18	51	30
Total	2,200	27	54	19

The points which emerge are :—

Flying stress.—Although in all these cases the neurosis was thought to be due to flying duties, in nearly a third the patients had not been subjected to any flying stress, and in less than half the cases was it more than slight. It will be seen that the percentage of those exposed to stress is about the same for pilots, wireless operator and air gunner, but is much less for navigators.

Non-flying stress.—Evidence of extraneous causal factors unrelated to flying were only present in a third of the cases, again the navigators experienced least, but on the whole this form of stress was uniformly distributed throughout the air crew.

Predisposition.—Seventy-three per cent of all the cases showed evidence at a short interview of constitutional liability to breakdown and 19 per cent were so heavily predisposed that had their shortcomings been recognised on entry it would have been reasonable to reject them since, as explained on page 121, this was laid down as the criterion of severe predisposition. This figure compares with 3 per cent, and the total of 73 per cent predisposed compares with 15 per cent in normal air crews (page 187). For this purpose normal air crews, men who had been admitted to hospital as a result of physical injury, and who had shown no evidence of a neurosis during their flying careers. The amount of flying experience which these men had had was comparable with that in the present series of cases. Men who break down as a result of their duties are consequently five times as likely to show evidences of contributional liability to breakdown as are normal members of air crews. Pilots who have broken down show the lowest incidence of predisposition and air gunners the highest.

Tables XV and XVI (*a*), (*b*) and (*c*) show that when the stress figures are similar, predisposition is also similar, but when stress is high, predisposition is low. This reciprocal relationship is well seen when the figures for Flying Training Command are contrasted with those for the Middle East. In Table XV however, predisposition for navigators is no higher and yet non-flying stress slightly lower, and flying stress is also considerably lower than for other categories. This category therefore furnishes an exception to the general rule. This anomaly indicates that a causal factor has been ignored for navigators and that the factor is not directly related to flying stress, non-flying stress or predisposition. Clinical impression suggests that this factor may be a combination of anxiety and fatigue arising from the continued intellectual effort which is the distinguishing feature of the navigator's duty.

Contrasting air gunners with pilots, the higher rate of predisposition in air gunners may be causally related to the higher incidence of breakdown among them. This higher percentage of predisposition may in turn be related to the method of selection which results in the acceptance as air gunners of a number of men who have been rejected as pilots. On the other hand, the air gunner is more exposed to anxiety in his duty on account of his relative isolation from the rest of the crew, and the opportunities for anticipation and reflection which are provided by long periods of inactivity. Because of this the psychological effects of danger may be greater in air gunners than in air crew of other categories.

It was shown on page 128 that there tends to be an inverse relationship between the stress encountered before breakdown and the predisposition to breakdown, those heavily predisposed withstanding little stress, those showing no predisposition often withstanding severe stress before the onset of a neurosis. This is, of course, only true in a large series of cases, the individual variation being enormous. (Figs. 3 and 4.)

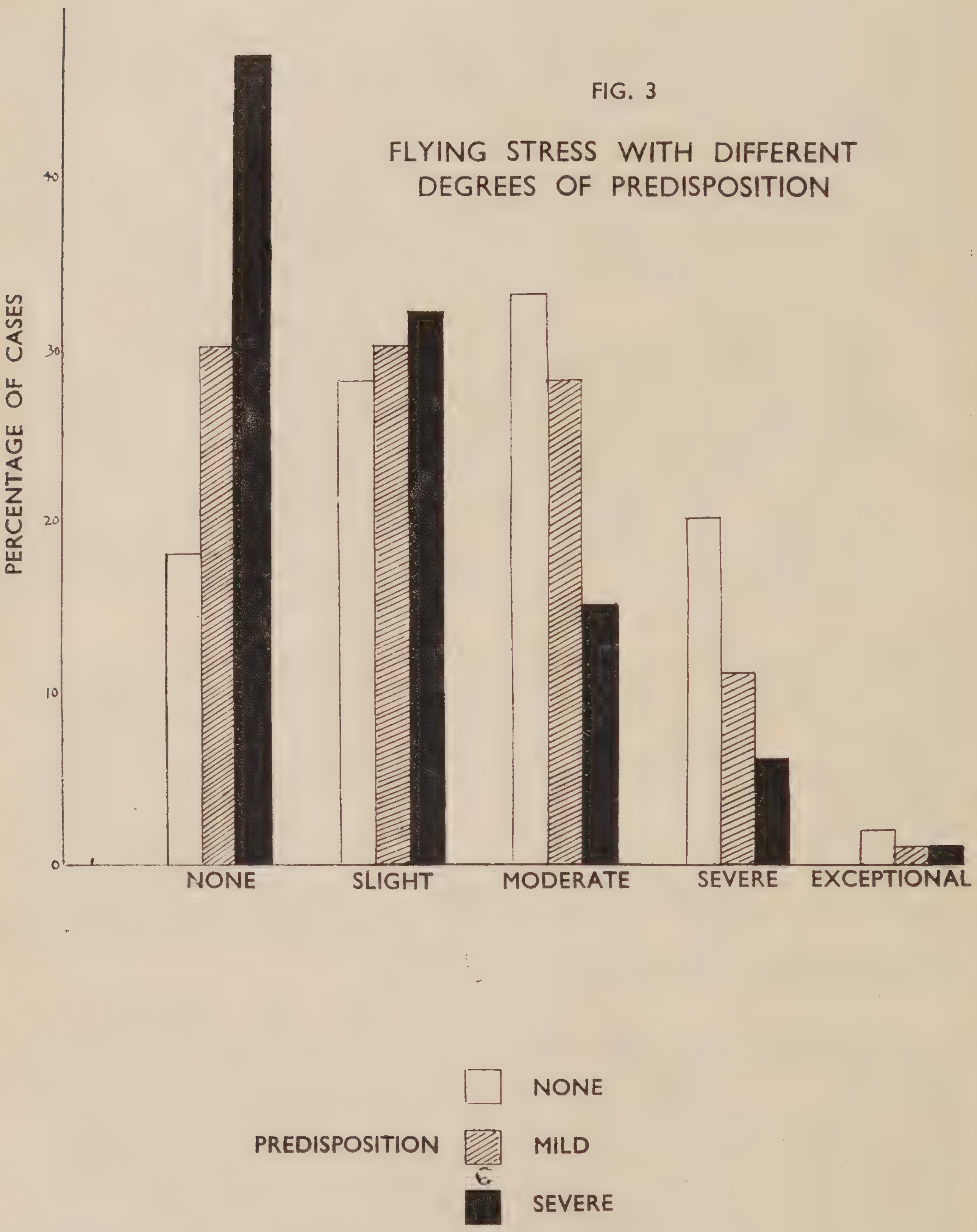
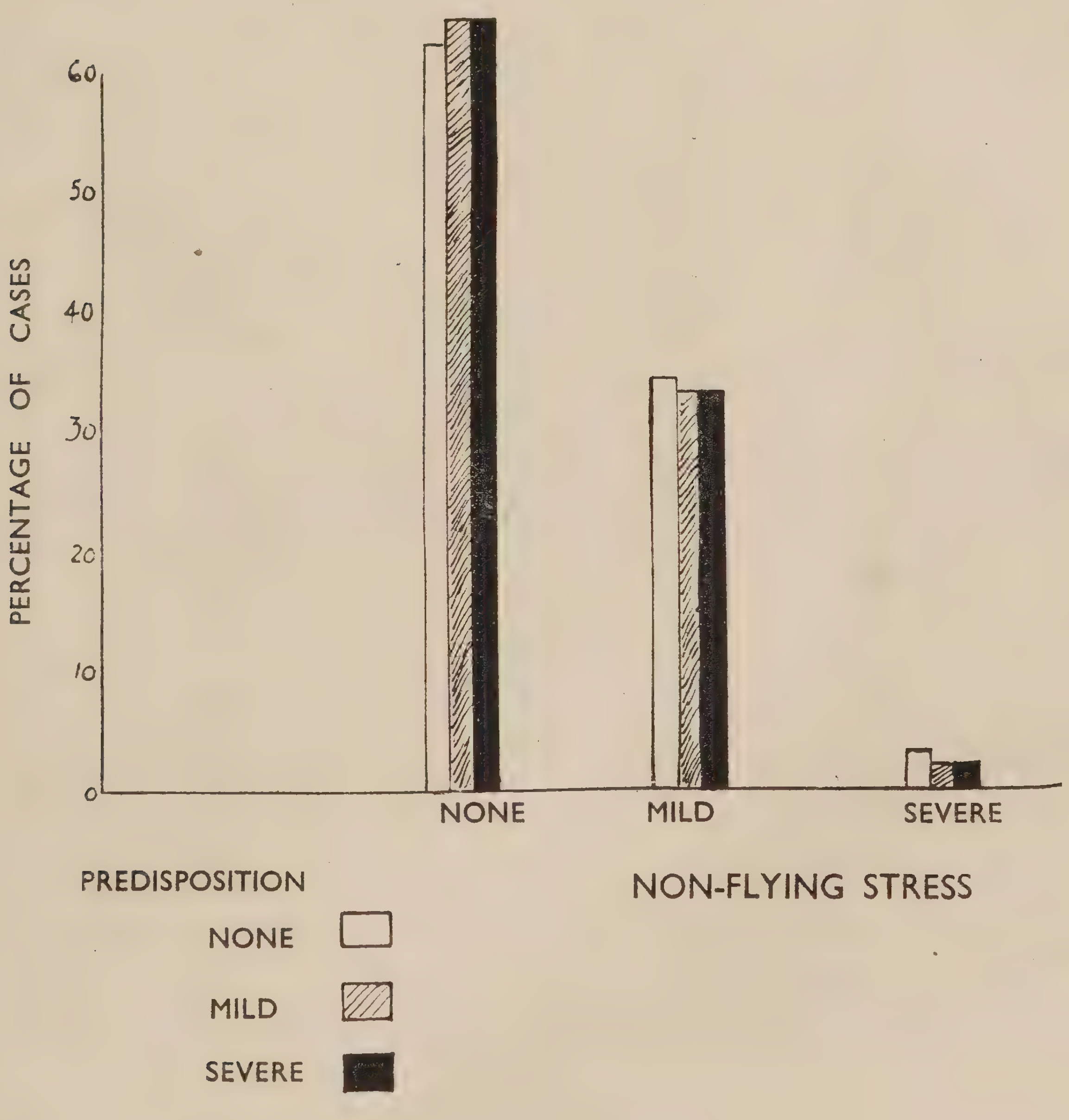


FIG. 4

NON-FLYING STRESS WITH DIFFERING DEGREES OF PREDISPOSITION



The proportion of cases showing the five different degrees of stress is similar in the three operational commands at home, but the stress required to cause breakdown in the Middle East is much greater and in Flying Training Command is much less (Table XVI (*a*)). On the other hand, other stress factors in the columns for non-flying stress presumably due to family separation and service overseas, are seen to play a greater part in the Middle East. The inverse relationship of predisposition to flying stress is clearly seen if Middle East Command, the home operational commands and Flying Training Command are compared (Tables XVI (*a*), (*b*) and (*c*)).

TABLE XVI(a)

Command	No.	Flying stress (per cent)				
		Nil	Slight	Moderate	Severe	Exceptional
Bomber	942	23	30	30	16	1
Fighter	197	22	32	34	11	1
Coastal	271	21	36	31	10	1
Army Co-operation	46	28	52	19	0	0
Middle East ..	299	11	25	35	25	4
Flying Training	455	67	22	9	2	0
Total ..	2,200	30	29	27	13	1

TABLE XVI(b)

Command	No.	Non-flying stress (per cent)		
		Nil	Mild	Severe
Bomber	942	67	31	2
Fighter	197	65	28	6
Coastal	271	61	36	3
Army Co-operation ..	46	50	48	1
Middle East	299	48	46	6
Flying Training	455	69	29	3
Total	2,200	63	33	3

TABLE XVI(c)

Command	No.	Pre-disposition (per cent)		
		Nil	Mild	Severe
Bomber	942	27	56	16
Fighter	197	34	45	20
Coastal	271	26	57	17
Army Co-operation ..	46	28	52	20
Middle East	299	40	46	13
Flying Training	455	17	53	31
Total	2,200	27	53	19

Further information about the causal role of these factors can be obtained by comparing this group with that of neurosis unrelated to flying duties and with the group lacking confidence as in Tables XVII (*a*), (*b*), (*c*).

TABLE XVII(a)

Group of cases	No.	Flying stress (per cent)				
		Nil	Slight	Moderate	Severe	Exceptional
Neurosis due to flying ..	2,200	30	29	27	13	1
Neurosis not due to flying	303	84	10	5	1	0
Lacking confidence ..	416	38	37	20	4	0

TABLE XVII(b)

Group of cases	No.	Non-flying stress (per cent)		
		Nil	Mild	Severe
Neurosis due to flying ..	2,200	63	33	3
Neurosis not due to flying	303	51	36	13
Lacking confidence ..	416	69	30	1

TABLE XVII(c)

Group of cases	No.	Pre-disposition (per cent)		
		Nil	Mild	Severe
Neurosis due to flying ..	2,200	27	53	19
Neurosis not due to flying	303	20	49	31
Lacking confidence ..	416	39	57	4

A note of warning is necessary when drawing conclusions from these tables. The physicians were instructed to make their assessments of each of the factors of stress and predisposition against a fixed standard, irrespective of the degree of prominence of the other two factors. Their diagnosis should similarly not have been affected by the weight of these factors, so that, for example, a man who showed no evidence of medical illness should have been called *A1B lacking confidence* whatever the stress or predisposition. Again, a man might well be considered to have developed an illness unrelated to flying duties, in the presence of considerable flying stress, and Table XVII (*a*) shows that this in fact occurs. Nevertheless the physicians are to some extent influenced by the prominence of any one of the causal factors both in assessing the other causes and in establishing the diagnosis. Although the flying stress factor is naturally of little moment in the group unrelated to flying duties, predisposition is severe in nearly a third of these cases, and the percentage of the cases with the more severe degrees of non-flying stress is higher than in the other two groups. In the columns for all three factors, the neuroses related and unrelated to flying duties make an interesting contrast, but the group of men lacking confidence shows a slightly lower rate of occurrence of flying and non-flying stress and a much lower rate of severe predisposition. There is, in fact, less reason to be found for the failure of these men to fulfil their duty than in cases of neuroses.

If there is indeed an inverse relationship between stress and predisposition, this should be apparent when comparing the degrees of stress of those with severe, mild and no predisposition (Table XVIII and Figs. 3 and 4).

TABLE XVIII

Stress in groups with differing degrees of predisposition

Pre-disposition	No.	Percentage of total							
		Flying stress					Non-flying stress		
		Nil	Slight	Moder-ate	Severe	Excep-tional	Nil	Mild	Severe
Nil ..	604	18	27	33	20	2	62	34	4
Mild ..	1,173	30	30	28	11	1	64	33	3
Severe ..	423	47	32	15	6	0	64	33	3

The table shows that total stress apart from flying is almost identical in the three groups, and that it is the flying stress which is responsible for the reciprocal relationship between stress and predisposition, since it falls steadily as predisposition increases in the three groups. A curve of the relationship of flying stress to predisposition based upon the data in Tables XV (*a*) and (*c*), and XVI (*a*) and *c*) is shown in Fig. 5.

This same relationship is also seen when the flying experience is compared with stress and predisposition (Table XIX).

FIG. 5

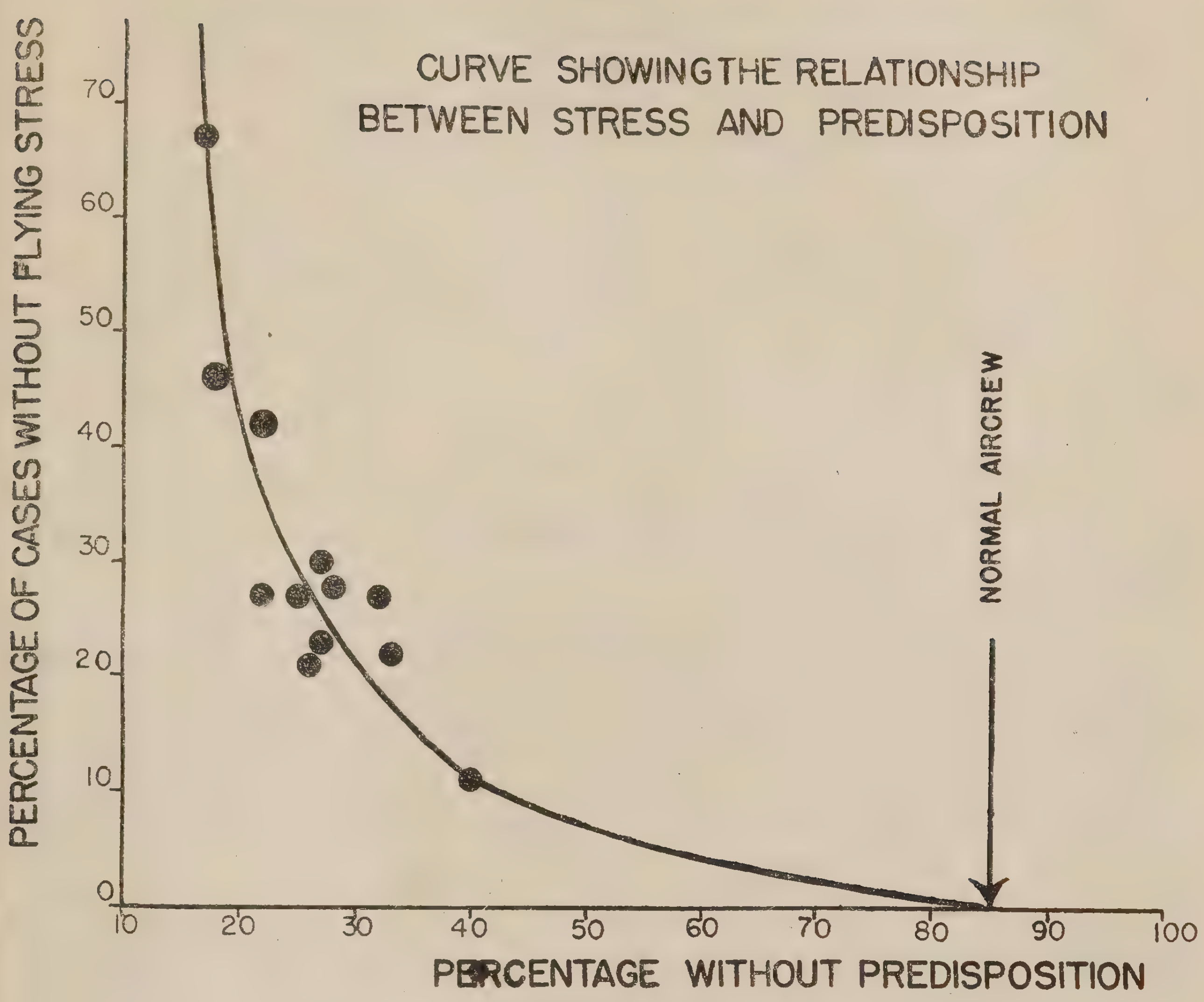


TABLE XIX

Flying experience compared with stress and predisposition

Flying	No.	Percentage of total							
		Flying stress					Predisposition		
		Nil	Slight	Moderate	Severe	Exceptional	Nil	Mild	Severe
No flying	106	100	—	—	—	—	14	50	36
No operations ..	676	56	29	12	3	—	20	53	27
Under 100 op. hours	688	18	39	29	12	1	26	56	18
Over 100 op. hours	730	8	24	42	26	3	37	52	11

It is obvious from this table that the inverse relationship again holds. There was again no such relationship between non-flying stress factors and predisposition, but the figures have not been included in Table XIX. A slight rise in the non-flying stress figures with an increase in flying experience has been shown to be related to the increasing age, and consequently the increased marriage rate (page 128 and again in Table XX, page 158).

TABLE XX

Relation of flying stress to increasing flying experience, age and marriage rate (percentage of total)

	No.	(Percentage of total)										
		Flying stress					Non-flying stress			Predisposition		
		Nil	Slight	Mod.	Severe	Exceptional	Nil	Mild	Severe	Nil	Mild	Severe
Married	817	28	34	26	10	1	56	41	3	25	55	20
Unmarried	1,383	31	26	27	14	2	68	29	2	28	53	19

Flying stress and predisposition are the same in the married and unmarried groups, but the number of those with environmental stress not due to flying is higher in the married men.

Figure 5 repays closer study. There is an inverse relationship between the proportion of subjects without evidence of predisposition or of flying stress, which in the middle range of subjects is roughly linear. At both ends of the curve, however, the degree of relationship changes, for at the end where the number of predisposed subjects is high, the proportion without stress rises very steeply with a slight rise in predisposition rate, and at the other end where stress is frequently encountered, the proportion of predisposed subjects falls rapidly with a slight rise in stress. Here the ordinate is cut at 85 per cent, that is, 15 per cent show evidence of predisposition. Thus, according to this graph even if every member of a group of neurotic flying personnel has been subjected to flying stress, the number predisposed will be 15 per cent of the total. It is obvious that at the very best the proportion of neurotic subjects predisposed to breakdown cannot be lower than that of normal subjects who have not broken down, and it is interesting that the theoretical continuation of the curve in Fig. 5 cuts the ordinate at a figure previously obtained by experimental observation. It is already stated (p. 151) that this 15 per cent predisposed is obtained by the same standards in normal men. Expressing these observations in terms of the clinical experience upon which they are based, groups of subjects with milder degrees of predisposition or of stress are equally likely to break down if either of these factors is increased, whereas the severely predisposed tend to break down, however slight the stress, and those exposed to great stress may break down, however small may be their degree of predisposition.

4. Causes of neurosis

The stress factors will now be analysed in further detail. The physicians were asked to enumerate the main causes of the illness in each case, the causes being psychological or physical. Physical causes were divided as they are in Table XXI, but the psychological causes were not divided because they are so many and overlap so much that statistical analysis cannot reasonably be applied to them.

It is strikingly shown in Table XXI that in virtually every case of neurosis arising from flying duties a cause (in nearly every case the main cause) is psychological. In only 9 of the 2200 cases was this not so, and in these 9 the illness arose directly from exhaustion, physical illness or injury. The nature of the psychological causes will be discussed later but since they are almost universally present their distribution need not be studied further.

TABLE XXI

Causes of neurosis arising from flying duties

Causes	Number	Percentage of	
		Causes	Cases
Psychological	2,191	76	99·6
Physical injury	399	14	18·1
Physical illness	212	7	9·2
Air sickness	52	2	2·4
Exhaustion	43	1	2·0
Cold	—	—	—
Altitude	—	—	—
More than one cause ..	676	23	—

(*a*) **Physical causes**

It is noteworthy that neither cold nor altitude were recorded as causal factors. From the introspective accounts of healthy men *extreme cold* appears to have a numbing effect upon the emotions as upon the senses and, as a result, anxiety gives way to apathy and mental strain is reduced. Reflection upon the painful experience of cold, and fear of its recurrence, and of impaired efficiency with resulting disaster have been reported in a few instances in Coastal Command, page 76, and Fighter Command, page 66, but we are not aware of any case in which this factor has appeared in the aetiology of a neurosis.

(*b*) **Altitude**

Altitude in the list of causal factors was intended to cover the effects of anoxia and decompression. As previously reported on page 66, it has been suggested by others that altitude may be contributory to the development of neurosis but experiment has failed to confirm the hypothesis that cumulative changes take place with repeated flights at high altitude (Matthews, 1941) and Table XXI shows that clinical observation supports this negative conclusion. Altitude may, however, operate in rare cases as a psychological factor, and when it does the occurrence is distinctive. There are some individuals who have a specific, irrational fear of height. This may appear in a pupil when he first does high flying or in an experienced man previously immune from such a fear under conditions of fatigue and worry. Examples as follows :—

Case 1 : P/O A. Aged 22, pilot. Day fighters, Spitfires. Flying hours 190, operational hours 25. His only complaint was fear of high flying. His mother had had two nervous breakdowns. Of his four siblings one was an artist, another a professional musician. His past history showed nothing suggestive of neurotic predisposition. He had led an active adventurous life, which included riding as an amateur jockey in Hong Kong for over a year. He had many falls but his nerve was unimpaired. He came home at the outbreak of war to fly, and enjoyed it until he began to fly at altitudes above 25,000 feet. He found that above this height he had a feeling of intense fear with an irresistible desire to get down.

Case 2 : S/Ldr. T. Aged 37, pilot. Instructor at a Flying Instructors' School. Flying hours 4,500. No operational hours. His only complaint was fear of altitude. His father when worried or tired was subject to feelings of unreality. His past history showed no evidence of neurosis. He had held a short service commission in a fighter squadron before the war, had stood up to average stress normally and had done a good deal of high flying without discomfort. He was called up from the reserve at the outbreak of war and has been instructing since. His symptom first appeared in March, 1940. While flying at 6,000 feet he had a sudden feeling of unreality and fear with an intense desire to get down. At this time he was separated from his wife because he could find no accommodation for her and, being lonely, was drinking more and sleeping less than usual. The feeling of unreality persisted 'as if I were dead and watching it all'. He was given a month's sick leave, returned to duty and has continued with it to the present time ($3\frac{1}{2}$ years) without complaint. The fear of heights has persisted. The feeling begins at about 2,000 feet, but its severity varies, being much greater if he is overtired or short of sleep. He is quite at ease on a low cross-country flight in bad weather, and unaffected by the ordinary mishaps. He recognises the irrational nature of his fear.

(c) Physical injury

Physical injury appears as a cause in 18 per cent of the cases. It may operate in several different ways. First, for the man who has been injured in a crash and admitted to hospital there is a greater tendency to reflect and ruminate upon his experience than in the man who is normally occupied. This factor which is of common occurrence needs no illustration. Second, the memory of an injury involving prolonged pain or residual disfigurement becomes a conditioned stimulus for anxiety. This is especially true of burns which are painful and disfiguring. Third, prolonged absence from flying may per se impair confidence; it is all the more likely to do so when the last experience of flying has been a crash. Fourth, the physical injury may provide the individual with a foundation for hysterical symptoms and, lastly, the physical effects of the injury, particularly if it is a head injury, may so lower the man's efficiency that he is unable to stand up to the stress of his occupation. The following case illustrates the third and fourth modes of operation :—

Case 3: F/O E. Aged 21, pilot. Under instruction at Day Bomber O.T.U. Flying hours 170. No operational hours. This officer was so overcome by fear in the air that he was unable to concentrate and his instructor reported him unfit to go solo. There was evidence of mild neurotic predisposition in the family and personal history. He passed through his training average or below average without mishap until he had a crash with minor head injury (traumatic amnesia 10 minutes) and was off flying for a month. On starting again he found he had lost his confidence. He also had slight dizziness. This was attributed to his head injury, and he was taken off flying holding a ground job for 18 months before he was returned to flying duties. Dizziness was included in his present complaints but there was no doubt that it was a hysterical symptom.

(d) Physical illness

Physical illness was recorded in nearly 10 per cent of the cases, operating by causing prolonged absence from flying with resulting loss of confidence; by causing symptoms which became the foundation of hysteria; or by contributing to fatigue and loss of confidence, as in Case 4.

Case 4: Sgt., pilot. Aged 21. Day fighters, Spitfires. Flying hours 300, operational hours 120. This pilot had remained well throughout his tour, which was highly concentrated into a short time, i.e. 120 hours in three months, and which included a number of combats with four enemy aircraft probably destroyed. He was beginning to feel the strain of three sweeps a day, and found that he was easily fatigued, was jumpy and tense. His wife had told him that he was stammering occasionally, and he said he was definitely looking forward to having a winter's rest and to coming off operations which he did not really like. At the end of November he developed pneumonia, was in bed for three weeks, and given 14 days' sick leave which he spent at home. He went to Central Medical Establishment and was given a further four weeks' leave. He then returned to four weeks' light duty at his station, on the ground. He had to report sick because he was nervy, he worried over trifles, found driving a car a strain, was easily tired, could not concentrate and was depressed. He did not feel that he would get back to operations. His past history showed that he was liable to get depressed for a day or so without cause, that he had been a nailbiter until 16, used to have frequent nightmares, and had always been unusually timid. His father was an unstable intellectual depressive, and his paternal grandmother had 'died of melancholia'. He was an only child. This pilot was already developing signs of a neurosis as a result of concentrated stress in the second half of his tour, but was unable to continue with his duties. His symptoms became worse, after a period away from flying, through physical illness, and led him to being permanently grounded. Having a personal and family history with evidence of liability to depression he was severely predisposed. It is likely that had he not developed the pneumonia he would, with careful handling, have been able to continue flying and may well have finished his tour. Flying stress was slight. Non-flying stress of his illness, mild.

(*e*) Airsickness

Airsickness may be a cause or a symptom of neurosis. It was recorded as one of the causes in 2·4 per cent of cases. The story was invariably that of a man who had experienced the trouble in the early stages of his training, with a persistent liability to airsickness under adverse conditions, which was not in itself disabling. This state may contribute to a neurosis of the affective type when the man has to face the strain of arduous flying duties and especially the stress of operations. He is aware that he is unable to give his best to the job when feeling airsick, and that he may therefore prove unequal to a critical task. His confidence in the air is undermined and even the prospect of rough weather is cause for anxiety and depression. In another group of men, airsickness which has been accepted and endured in the earlier stages of training is later presented in exaggerated form as an hysterical symptom. The motivation behind this is a desire to escape from flying, resulting perhaps from some unpleasant experience, or from the realisation at the O.T.U. of the imminence of the operational hazard. Sickness in the air, of course, may be a *neurotic symptom*, and anxiety may aggravate genuine airsickness. The distinction between cause and effect is sometimes difficult, but the criteria stated above for airsickness as a causal factor were those used by all observers in the present investigation. It is worth noting that airsickness as a cause of neurosis appears in only 0·5 per cent of pilots as compared with 5·0 per cent of other crew categories taken together, an observation which confirms the impression that in the air or on the land the driver of the machine is less vulnerable to sickness than his passengers.

(*f*) Exhaustion

Exhaustion appearing in 2 per cent. of cases included such causes as a spell of intense operational activity with short sleep, a prolonged period during which flying hours were excessive, or the physical effect of hardship and exposure following a forced landing in the desert or in the sea. Such experiences were sometimes the main precipitating cause of affective disorder, of which the following is an example :—

Case 5 : F/Lt. W. Aged 23, pilot. Flying hours 600, operational hours 80 on day bombers. His complaint was of sleeplessness and depression. The family history showed a liability to depressive illness of mild type. The personal history was normal, but his reserve of confidence in the air had never been high. He had a reputation for going through any kind of weather, which was deserved. He was, in fact, frightened of it but extremely conscientious. His symptoms began after a period of intense operational activity, during which he did not have his clothes off for five days and had very little sleep. At the end of this, in a state of fatigue, he forgot his flaps coming in to land and piled up his aircraft with full bomb load, fortunately without loss of life. After this he lost confidence in his ability to fly, was frightened and uncertain when he attempted to do so, and when grounded was depressed and sleepless and self-reproachful.

In persons with no evidence of predisposition, exhaustion usually results in symptoms of fatigue, but this relationship will be considered further under the heading of *Fatigue Syndrome*, pages 166–167.

(*g*) Psychological causes

The main psychological causes, which were present in almost every case, were by the method of selection of this group of cases outlined on page 140 related to flying duties. Clinical and executive experience agrees in the conclusion that the most important single psychological cause of neurosis in air crew is *fear*.

Skill fatigue (Bartlett 1941) is a factor of secondary importance and when it contributes to neurosis usually acts by undermining that confidence which normally affords protection from mental strain. The development of a neurosis from fear in flying personnel has been discussed in some detail (pages 104–106) (Symonds 1943). The main points which arose were as follows. Flying and especially operational flying contains so many hazards that fear is to be expected, but as the result of a number of factors which include innate tendencies, past education, flying training, experience and especially group morale, fear is inhibited, so that the normal individual is *relatively fearless* under average conditions of stress. To this extent he is spared the strain of emotional conflict, but when as the result either of constitutional defect (predisposition) or greater stress, inhibition is weak and there is excess of fear, emotional conflict reaches a point at which one of two things happens. Either the man gives up the struggle and so he falls into the *Lack of Confidence group* (or as the result of inefficiency he is discarded) or he goes on to develop a neurosis.

The *pattern* of the neurosis depends upon factors which will be discussed under Reaction Types, pages 163–164, but the *ætiology* is remarkably constant. Fear of flying or of some particular aspect of operational or non-operational flying is the start. This may have been present ab initio but has more commonly developed as the result of some unpleasant experience. An attempt is made to carry on with flying duties, but excessive fear persists. The neurosis develops as the result of the intensity and extent of the fear state and the tension of the emotional conflict. Since psychological causes were present in almost all the cases of this series, the relationship of the incidence of neurosis and the time of its onset to the hazards should illustrate the part played by fear. There should for example be a direct relationship between incidence and hazard of duty. This is so. In Table VIII, page 147, it was shown that in 1942–43 the incidence of neurosis in bomber operations was over twice that on fighter operations, and in Table VII that it was nearly twice as high in day fighters as in night fighters and as in Coastal Command. The actual casualty rates are not available, but a factor showing the relationship of flying hours per casualty has been obtained for five duties. This is shown against the neurosis rate in Table XXII.

These duties are taken as samples, but they indicate what is apparent throughout the results, that there is a relation between the likelihood of breakdown and the hazards encountered. If fear of these hazards is the most potent cause of breakdown it might be expected that the rate of breakdown will increase steadily as the flying career advances from elementary training, through operational training, to the ultimate hazard of operations. That this is so for all commands is shown in Table VIII, page 147, and that the breakdown rate is related to the hazard of the job is shown in Tables VII and XXII.

TABLE XXII

The relationship between breakdown and risk

Duty	Incidence of neuroses	Safety factor*
Bomber operations	12·0	160
Fighter, day	6·0	188
Fighter, night	3·4	231
Coastal Command	3·3	360
Training	1·1	1,960

* The *safety factor* represents an indication of the relative flying hours per casualty in these duties.

(*h*) Fatigue

It has been asserted that fatigue plays a secondary part in the ætiology of neurosis in air crews. This is supported not only by clinical experience and by the views of general duties officers in commands but also by the figures of incidence of neurosis, which are lower in Coastal Command and in night fighters than in other more hazardous but less tiring duties. One per cent of the present cases arose in crews of flying boats in Coastal Command and it was shown (page 137) that the incidence of all neuroses among crews in this arduous duty was lower than in other operational duties.

So far only the exogenous factors, such as leadership, pages 53–54, and 76–78, discipline, pages 57–58 and 67, and crew spirit, pages 51–52, which fortify the individual against breaking down under the stress of his duties have already been dealt with.

As the exogenous factors unassociated with flying—domestic worry, financial difficulty, sexual maladjustment and the restrictions of Service life in wartime—have been shown in most cases to play an insignificant part in causing neurosis arising in air crews as a result of their duties, they will not be analysed further. The figures from the Middle East show, however, that in special circumstances they may play an important precipitating part (see page 154).

The endogenous factor in the causation of neurosis is discussed, in this and on page 122 and pages 193–194. In nearly three-quarters of the 2,200 cases of this series there was evidence in either the personal or family history or both, of predisposition to neurosis. As already explained, by the same standards that have been applied to these cases 15 per cent of normal flying personnel are similarly predisposed to breakdown, 3 per cent severely so, and it seems that when exposed to the stress of fear and fatigue these individuals are more vulnerable than the rest, since the predisposition rate is five times as high in men with neurosis as in normal men.

5. Reaction types

Another aspect of neurosis arising from flying duties is the clinical pattern presented. In this series it was found possible to place every case into a restricted set of diagnoses based entirely upon accepted psychiatric nomenclature, so that although special causal factors may be present the actual types of psychological disorder to which they give rise are the same as those encountered in civil practice.

TABLE XXIII

Proportion of different reaction types (2,200 cases)

Reaction types	Percentage of cases
Anxiety state	79·1
Hysteria	12·8
Depression	9·6
Fatigue state (neurasthenia)	6·9
Obsessional	2·2
Schizophrenic	0·4
Elation (mania)	0·3
Chronic organic reaction	0·2
Acute organic reaction	0·2
Mixed forms	11·1

The classification adopted follows conventional lines. Neurosis for this purpose is interpreted as minor mental disorder, so that a mild schizophrenic or hypomanic case is included. No heading was allowed for psychopathic personality, the omission being deliberate, for it was considered that such a pigeon-hole might be variously used by different observers and that the psychopath with a neurosis caused by flying duties would probably develop symptoms falling under one of the other headings. This expectation was fulfilled in the few cases of this type which were reported. It is to be noted that an *anxiety state* was recorded in 79 per cent of the cases. Comparing this with other figures for Service patients, we note that Cooper and Sinclair (1942) dealing with neurotic casualties in the field, found 64 per cent of anxiety states. Love (1942) in Tobruk found anxiety states with or without hysteria in over 90 per cent. Dillon (1940) records a 70 per cent incidence of anxiety states among neuroses seen at casualty clearing stations in the last war. These figures from comparable material—for exposure to flying stress is fundamentally little different from exposure to battle stress—correspond nearly with our own. In the cases admitted to a psychiatric hospital the incidence of anxiety states is lower. Hadfield (1942) found it 53 per cent and remarks that among the conditions seen near the battle zone there are probably many cases of ordinary anxiety and panic which should not be classified as neuroses. In the present series of cases this objection cannot be upheld for in the first place cases of non-persistent anxiety in air crew are treated by unit medical officers either as out-patients or in station sick quarters, and are not referred to the neuro-psychiatrists at all ; and of those referred to a neuro-psychiatrist one in seven (see page 140) is held not to be suffering from a neurosis despite lack of confidence.

An alternative explanation for the high incidence of anxiety near the battle zone and in flying personnel is that there is a direct relation between the nature of the stimulus and the pattern of reaction. The distinctive feature of an anxiety neurosis is a morbid state of fear, and fear is more likely to be excited in the air than on the ground, and in the battle zone than behind it. The suggestion of such a relationship between natural fear and morbid fear involves the discussion of thorny questions. What is the definition of an anxiety neurosis ? What is the distinction between morbid fear and natural fear ?

These questions deserve careful consideration in the light of clinical experience gained in the present war and have been discussed in Chapter VIII (Symonds 1943). It must suffice to state some of the difficulties encountered in the classification of cases and the ways in which they have been met. Broadly speaking, there are two possible definitions of anxiety neurosis. One is descriptive, the other in terms of psychopathology. The former defines anxiety neurosis as a state of morbid, exaggerated or unjustified fear : the latter requires evidence of mechanisms such as unconscious conflict, repression and displacement of effect. Acceptance of the definition in terms of psychopathology would certainly exclude a large number of the cases accepted in this report as anxiety neurosis. In our experience the subject is more often than not fully aware of the nature of his disability and its causes. He is frightened of flying, or it may be of flying under certain conditions, or in certain aircraft. He may at one extreme always have been frightened of flying : or at the other extreme he may have developed his fear only after a succession of appalling catastrophes. He is aware that it is his duty to carry on and attempts to do so ; usually he succeeds for a time despite his fear. The anticipation of flying then becomes a constant preoccupation : the very sight or sound of an aeroplane may aggravate or excite fear. The liability may extend further so that the sound of a siren, driving in a motor car, or riding a horse excites fear where none existed before. This state of fear is associated with the usual bodily symptoms of fear and tension and with insomnia. The effort for the man to carry on despite his fears becomes more and more exhausting. Eventually he either reports sick, tells his commanding officer he cannot continue, or is sent to the doctor because his comrades or superiors have observed inefficiency or alteration of behaviour.

When seen by the doctor some of these men over-emphasise their physical symptoms as an excuse for failure, but a great many are perfectly frank in admitting that the root of the matter is their fear of flying. In terms of the descriptive definition it is easy to take the first step towards the diagnosis of anxiety neurosis. These men are obviously suffering from a state of fear. The difficult question to decide is whether their fear is morbid (exaggerated, unjustified) or within normal limits. This question has been often posed before for combatants of all arms and was discussed freely before the War Office Committee of Inquiry into Shell Shock, 1922, who could only arrive at the conclusion that if a man had exercised self-control, and tried his best to face up to the danger he should not be regarded as a coward, though there was but an 'indefinite line which divides normal emotional reaction from neurosis with impairment of volitional control.' Undue persistence of fear reactions after danger had passed, and recurrence with inadequate stimulus were considered evidence in favour of a pathological state. We believe that in fact there is no stable line of distinction between anxiety neurosis and normal emotional reaction, but that in the interests of morale, a line must always be drawn. Its position will vary with the group attitude towards danger. If a civilian in time of peace suffered injuries in an air crash, which had involved the death of others, including his friends, and thereafter became permanently afraid of flying, no one would regard that fear as unnatural. In an operational squadron, however, an episode of this kind is accepted by the majority as within the limits of normal experience. A persistent fear reaction therefore against this background would be morbid. Even so, whether it should be called neurosis depends upon the further question whether the man had tried hard enough to satisfy group standards. Every medical officer who has had to deal with these cases has realised the necessity of an arbitrary distinction of some kind. The report by Cooper and Sinclair from Tobruk provides a good example. Of the soldiers seen with anxiety states rather more than half were returned to their units with the diagnosis of fear state and a recommendation that if necessary they should be evacuated through channels other than medical. The remainder were accepted as cases of anxiety neurosis.

In the R.A.F. the majority of cases in which there is need for distinction are referred to the neuro-psychiatric specialists who, before accepting the case as an anxiety neurosis, require evidence first that the fear state is so persistent or recurrent that it is disabling. Objective evidence such as loss of weight, pallor, tachycardia and tremor are held important, as also a report from the unit medical officer of abnormal behaviour. The report of the commanding officer (which is always required in these cases) is given due weight, for it will indicate whether the man is considered to have tried his best. The attitude of the man towards his situation is also regarded as important. If he is willing to continue with flying duties if found fit this is a point, other things being equal, in favour of accepting the case as one of neurosis. In the distinction between anxiety neurosis and cowardice expediency usually in the end counts more than scientific judgment. This should surprise no one who has reflected upon the part played by group opinion in deciding when individual behaviour should be regarded as pathological.

Depressive states were recorded in 9·6 per cent of the cases. As this series was limited to neurosis attributed to flying duties the cases were naturally more reactive than endogenous. We agree with Curran and

Mallinson (1941) that there is no sharp line of distinction between these types. The common story is that of fear unsuccessfully resisted by a conscientious individual with subsequent self-reproach.

The incidence of *hysteria*—12·8 per cent—agrees nearly with the experience of Love (11 per cent) and Cooper and Sinclair (16 per cent) in the battle zone of Tobruk. Whereas the distribution of the affective disorders in the different crew categories shows practically no variation, the figure for hysteria in pilots (11 per cent) is slightly below the mean of 12·8 per cent and that for air gunners (16·9 per cent) well above it. This difference may be causally related to the different standards of selection of these two categories. Forty per cent of all the cases of hysteria in men under training as compared with 25 per cent of the cases of anxiety and 23 per cent of the depressions, indicating that the man who is going to develop hysteria does so relatively early in his flying career.

TABLE XXIV

Comparison of proportion of anxiety, hysteria and depression in the neuroses related to flying duties with those not so related

Reaction	Percentage Related to flying duties	Percentage Unrelated to flying duties
Anxiety	79	55
Hysteria	13	21
Depression	10	16
Total	102	92

It is seen that anxiety states are more commonly encountered when the neurosis is related to flying duties. It may well be that this is brought about by the important part played by fear in causing these neuroses. This is supported by the observation that although the incidence of anxiety states is very high in cases of neurosis arising in all duties, it is higher in the operational commands than in Flying Training Command.

TABLE XXV

Percentage of cases with anxiety states under commands

Command	Percentage of cases with anxiety states
Middle East	83
Bomber	82
Coastal	82
Fighter	76
Training	71

The *fatigue syndrome* for purposes of this investigation was defined in terms of symptoms—complaint of mental or bodily fatigue and other symptoms which could not be satisfactorily explained in terms of any other neurosis; it was practically synonymous with neurasthenia, and of equally doubtful value. The state of exaggerated fatigue appears generally to be the result of prolonged emotional conflict, although it may not as first be admitted. In some cases skill fatigue or physical exhaustion have contributed, but the main cause is usually psychological. Thus of the cases of fatigue syndrome 97 per cent showed a psychological cause, 11 per cent exhaustion. That skill fatigue does, however, play a part in this syndrome is suggested by the fact that the fatigue syndrome is twice as common in pilots as in other air crew categories taken together.

TABLE XXVI

Percentage of fatigue syndrome for different duties compared with that of all neuroses

Duties	Percentage of fatigue states	Percentage of all neuroses	Ratio fatigue to all neuroses
Bomber, night	35	36	1·0
Instructor	24	12	2·0
Fighter, day	16	10	1·6
Under training	7	27	0·25
Coastal operations ..	7	10	0·7
Bomber, day	5	7	0·7
Fighter, night	2	3	0·7
Total cases ..	151	2,200	

Fatigue states show no great difference in distribution from that of all neuroses except in instructors, where fatigue is twice as high and in pupils where it is four times as low. The syndrome in instructors, besides being more frequent, is more clearly defined. The story is that of prolonged employment on this duty with first loss of interest in the job, then a lowered threshold of fatigue, and irritability. It is usually because he finds himself becoming unreasonably angry with his pupils that the instructor reports sick.

The causal relationship of exhaustion to the reaction of a fatigue syndrome is shown by the ratio of the proportion of neuroses with exhaustion as a cause to all other neuroses in the different duties. This ratio is two in the cases of Instructors and a quarter in pupils. It appears, therefore, that the fatigue syndrome is most likely to be produced by a kind of exhaustion which is most common in Instructors and least common in pupils.

9. Prognosis of neuroses

Some idea of the prognosis of neuroses resulting from flying duties can be obtained from the disposal recommended by the Central Medical Board after the physicians had seen the cases. The Board disposals were divided into temporary and final. Sixty per cent of the 2,200 cases were given a final disposal as in Table XXVII.

TABLE XXVII

Final disposals by the Central Medical Board

Final disposals	Percentage of 1316 cases	
Full flying	29·5	38·4
Limited flying	8·9	
Ground duties	60·5	
Invalided	1·1	

Of the 501 men who returned to flying duties 27 (5·4 per cent) had relapsed during the year covered by the investigation. Thus, in this group approximately one-third of the men with neurosis due to flying duties severe enough to warrant consultation with a neuro-psychiatrist returned to duty and remained well during the time covered by this investigation, while two thirds were removed from flying duties.

During the year, 1293 cases (58 per cent) were given a temporary disposal, as follows :—

Temporarily limited flying	27 per cent
Temporarily grounded	31 per cent

In many of these cases the temporary disposal was merely a step in the man's progress to flying duties, and in many instances temporary ground duties represented a period of hospital treatment or of sick leave. Twenty-eight per cent (356) of these, two thirds of whom had had a period of temporary employment on the ground, usually sick leave, went on to be given a final disposal, as in Table XXVIII.

TABLE XXVIII

Final disposals in cases having a temporary disposals

	Per cent	
Full flying	45·2	56
Limited flying	10·7	
Grounded	44·4	
Invalided	0·6	

Further investigation showed that only 17 per cent of patients who are given a final disposal without any of these intermediate steps attain a full flying category, so that Table XXVIII shows that the prognosis is nearly three times as good in those who have had a temporary disposal. This simply means that the physicians decided in some cases at one interview that the man was unfit for any further flying and in other cases that with a period of rehabilitation the chances of his returning to flying were reasonable. As the relapse rate for all the patients returned to duty within the year was only 5 per cent, their judgment was usually sound. It is important to observe that although 60 per cent of the patients were grounded, only 1 per cent were invalided. This means that when a member of a crew develops a neurosis as a result of flying duties the prognosis, once he is removed from those duties, is such that he is thought to be able to assume new duties in the Service, and experience shows that recovery is usually so complete that he can assume full ground duties.

Table XXIX shows that pilots who have developed a neurosis are twice as likely to return to flying duties as are other members of air crew.

TABLE XXIX

Prognosis in relation to air crew categories

Category	Percentage with final flying category	
	All cases	Cases with temporary disposal
Pilot	54	70
Navigator	27	42
Wireless Operator	25	44
Air Gunner	25	45

TABLE XXX

Relation of flying experience to prospect of returning to flying duties

Experience	No.	Final disposal (percentage)		
		Full flying	Limited flying	Grounded
No flying	87	9	1	84*
No operations	475	22	5	73
Under 100 op. hours	415	29	12	59
Over 100 op. hours	339	45	12	43

* 5 per cent invalided

There are two factors, the first that the man who breaks down early in his flying career is likely to be more heavily predisposed than his fellow who has been able to withstand greater flying stress before breaking down, and consequently has a better prognosis, and the second that, as experience has shown that the chance of ultimate success in a man who has broken down early in training is small, the physician tends to advise rejection more readily in a case of this type.

TABLE XXXI

Prognosis in relation to predisposition

Pre-disposition	No.	Disposal percentage	
		Full flying	Grounded
Nil	317	57	31
Mild	677	26	63
Severe	335	8	85

The last factor to be considered in relation to prognosis is that of the stress to which the man has been subjected. This is shown in Tables XXXII (a) and (b).

TABLE XXXII (a)

Prognosis in relation to flying stress

Flying stress	No.	Disposal percentage	
		Full flying (385)	Grounded (813)
Nil	493	21	73
Slight	401	27	61
Moderate	290	37	48
Severe	133	45	46
Exceptional	12	41	33

TABLE XXXII (b)

Prognosis in relation to non-flying stress

Non-flying stress	No.	Disposal percentage	
		Full flying (385)	Grounded (813)
Nil	874	28	62
Mild	421	30	59
Severe	34	50	50

These two tables show that in cases of neurosis arising from flying duties the greater the stress to which the patient has been subjected, the greater the chance that he will be able to return to full flying, and the less likely is he to be permanently grounded.

10. SUMMARY OF RESULTS

(1) 2,200 out of 2,919 cases of neurosis in flying personnel seen by neuro-psychiatrists were thought to have neurosis arising mainly from flying duties. Such cases have formed the basis of this report.

(2) In the same period of time the neuro-psychiatrists saw 303 flying personnel with neurosis not considered to be due to flying duties and 416 personnel without neurosis but lacking in confidence.

(3) 46 per cent of the 2,200 cases occurred in pilots, 21 per cent in wireless operator/air gunners and 14 per cent in navigators (Table I, page 142).

(4) 43 per cent arose in Bomber Command and 20 per cent in Flying Training Command, while Fighter Command only contributed 9 per cent. A third of the cases occurred in night bombers, a quarter in pupils and a tenth each in instructors and day fighters (Tables II and VI, pages 142 and 145).

(5) The incidence of neuroses attributed to flying duties was calculated for all commands, duties and crew categories, from the average crew strengths and the rate of flow of crews during the year, the incidence being expressed in each instance per hundred man-years. A hundred man-years might represent a hundred men exposed to risk for one year, or four hundred for three months each, and so on. This provides a unit which is reasonably applicable to any command, duty or crew category, and enables the incidence figures to be compared with each other. The incidence, per hundred man-years, was 3·2 for the whole Royal Air Force : air gunners with 5·2 having the highest incidence, and pilots and navigators with 2·8 the lowest (Table III, page 142).

(6) In operational commands the average incidence was 5 per cent man-years, air gunners having 6·7 and pilots 5·4, navigators and wireless operator/air gunners being almost equal. This relationship obtained for all these Commands. By contrast the incidence was 1·3 in Flying Training Command, the figures for crew categories being more uniform. (Tables IV and V, page 144.)

(7) In duties the incidence in night bombing was 12 per cent man-years, in day bombers 11·2, and Middle East operations 9 to 10·4 : while in day fighters it was only 6, in night fighters 3·9 and Coastal Command 3·4 per cent. (Table VII, page 145). Thus the incidence of neurosis attributed to the duties of bombing was nearly four times that for the whole Air Force, it was twice that of day fighting and nearly four times that of night fighting. The incidence of about one per cent. for trainees was a fifth of that for operational Commands (Table VIII, page 147).

(8) There appeared to be a direct relationship between the incidence of neurosis attributed to flying duties and the degree of danger of the duty. The opposite appeared to be the case when the neuroses are not attributed by the physicians to flying (Table X, page 147).

(9) Neuroses arising from flying duties were equally distributed between men who had not flown on operations, who had started their tour and who had had considerable experience of operations. Five per cent of cases arose in men who had not flown at all. By contrast more men ceased flying without neurosis, lacking confidence, at the beginning of the tour than at any other time (Tables XII and XIV, pages 148 and 149).

(10) Over half of the patients had not been exposed to more than slight stress while flying, and nearly a third to none at all ; two thirds had experienced no psychological stress apart from flying (Tables XV (a) and (b), page 150).

(11) Three-quarters of the patients showed evidence at a single interview of predisposition to neurosis and a fifth were so heavily predisposed that in the opinion of the physicians they should have been rejected had their disability been recognised on entry (Table XV (c), page 150).

(12) A higher rate of predisposition in air gunners than pilots was associate with a higher breakdown rate. Predisposition was least evident in patients from operational duties or in those who had been exposed to great flying stress (Tables XVI (a), (b), (c) and XVIII, pages 154–156).

(13) A contrast in the incidence of predisposition and stress was found between the group of patients under review and the group lacking confidence and having neuroses not due to flying duties.

(14) When the incidence of flying stress and predisposition was compared in different groups of subjects, an inverse relationship was found to exist between these two factors. In groups where one of these factors was preponderant, the causal significance of the other factor was slight. (Tables XVIII, XIX, XX and Fig. 5, pages 156–158).

(15) The main cause in almost every case was psychological and the most important single cause was fear, fatigue playing a subsidiary part if present at all. Physical injury contributed to the neurosis in 18 per cent and illness in 9 per cent. Airsickness and exhaustion were each contributary in only 2 per cent, and cold and altitude were never considered causal (Table XXI, page 163). As fear is the most important single cause it follows that there is a direct relationship between the incidence of the neurosis and the degree of risk encountered. (Table XXII, page 162).

(16) Nearly 80 per cent of the patients had anxiety states, but the occurrence of anxiety appeared to be related to the degree of danger encountered (Tables XXIV and XXV, page 166). 13 per cent had hysteria, 10 per cent were depressed and 7 per cent had a fatigue state (Table XXIII, page 163). The incidence of fatigue states was related causally to exhaustion.

(17) 38 per cent of all cases of neurosis in flying personnel who see a neuro-psychiatrist are returned to flying, but in those cases for whom an intermediate category of temporary ground duty or limited flying was recommended, 56 per cent to flying duties. The relapse rate during the year in which the patients were seen was 5 per cent (Tables XXVII and XXVIII, pages 167–168). The chances of returning to flying duties are greatest in pilots (Table XXIX, page 168), experienced air crews (Table XXX), those with little predisposition to neurosis or who have experienced considerable stress (Tables XXXI and XXXII (a) and (b), pages 169–170).

(18) These observations have been related to clinical psychiatric experience and discussed with examples from patients interviewed personally. It is apparent from the results obtained that the problem of neuroses arising as a result of flying duties only differs from the problem of neuroses encountered in civil life in the kind and degree of psychological stresses encountered, which in turn depend upon the specialised and hazardous nature of the patients' duty.

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CHAPTER XI

OCCURRENCE OF NEUROSIS IN ROYAL AIR FORCE AIR CREW IN 1943 AND 1944

by

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Introduction

This chapter deals briefly with the main facts relating to neuroses which have arisen in flying personnel in the past year. Detailed analyses of the incidence, nature and causes of neurosis in air crews are presented in Chapters IX and X), and the present chapter should be supplemented by reference to the earlier ones if a fuller study of the subject is intended. When it has seemed useful, however, figures relating to neurosis in the air crews in 1942 have been included here for comparison. The figures are obtained from a statistical survey of psychological disorder in 1,197 flying personnel which occurred in the six months beginning February 3rd, 1942 (Chapter IX). The general conclusions deduced from the present statistics support those expressed in the previous chapters. The method of collecting and assembling the data has already been described (pages 118–120).

1. Cases with a frank neurosis

In the year beginning February 10th, 1943, Royal Air Force neuro-psychiatrists thought that 2,989 flying personnel seen by them were suffering from a neurosis, and that another 307, although not suffering from neurosis lacked confidence for their flying duties. Thus a total of 3,296 men (compared with 2,919 in 1942–43) were seen who were either unable or unwilling to carry out their flying duties. This number, representing nine a day, does not include those dealt with directly by the unit medical officer, or those who because of psychological disorders are handicapped in their duties, and though inefficient do not reach the medical branch. Those with a frank neurosis, 2,989, will form the substance of the report. They came from the following commands :—

TABLE I

Distributing cases of neurosis under commands (all crew categories, including those under training)

Command	No.	Percentage of total	Percentage 1942 (page 119 Table I)
Bomber	1,022	34·1	41·9
Flying Training*	969	32·4	22·3
Middle East	402	13·5	10·4
Coastal	316	10·6	13·3
Fighter	270	9·0	9·0
Maintenance and Transport	10	0·4	—

(* This includes 26 wireless operators under training in Signals Schools of Technical Training Command.)

In each of the operational commands at home, over a third of the cases came from training units, as follows :—

TABLE II

Cases of neurosis in operational commands at home (including air crew under training, instructors and those employed on staff and other duties)

Command	Units	
	Operational	Training
Bomber	727	295
Coastal	226	90
Fighter	200	70

TABLE III

Distribution of cases of neurosis under crew categories

Category	No.	Percentage of total
Pilot	1,054	35·1
Navigator*	577	19·2
Wireless Operator†	541	18·4
Air Gunner	450	15·0
Air Bomber	136	4·6
Flight Engineer	128	4·3
P.N.B.	103	3·4

* includes :—

Navigator	380
Navigator B., W., and B.W.	155
Navigator Radio	45
	577

† includes :—

Wireless Operator	525
W/Operator-Mechanic ..	16
	541

It will be seen from Table IV that although the order in which the various duties contributed has remained similar, the relative proportion of neurosis recognised in men under training has risen appreciably. As the figures represent occurrence of neurosis, and not incidence, these changes may possibly be due to an increase in the number of men at risk in the various duties. From the evidence available it is, however, unlikely that this factor has affected the number of cases of neurosis under training to the degree shown in the table.

TABLE IV

Duties considered chiefly responsible for the illness, or which were being performed at time of onset of symptoms

Duties	No.	Percentage of total duties	Percentage 1942 (page 119 Table II)
Under training	1,117	35·9	28·7
Night bombing	829	26·7	28·5
Instructing	266	8·6	11·1
Coastal General Reconnaissance	232	7·5	9·2
Day fighting	214	6·9	8·6
Day bombing	107	3·4	7·0
Staff and other duties	101	3·4	—
Coastal boats	60	1·9	0·4
Night fighting	60	1·9	1·4
Coastal offensive duties	47	1·5	1·3
Ferrying	30	1·0	0·2
Army Co-op. (Middle East) ..	21	0·7	—
Air Sea Rescue	11	0·3	0·3
Photographic Reconnaissance ..	7	0·2	0·4
Test pilot	6	0·2	—
Total	3,108*	100·1	97·1†

* In 119 cases two successive duties, usually instructing and an operational duty, were together thought to have been responsible for the neurosis.

† Duties in Army Co-operation Command contributed 2·8 per cent.

2. Flying experience

TABLE V

Relationship of flying experience to the time of breakdown

Flying experience	No.	Percentage of total	Percentage 1942 (page 120 Table IV)
No flying	284	9·6	7·9
No operational flying	1,109	37·0	31·2
Under 100 hours ops.	816	27·3	24·8
Over 100 hours ops.	780	26·0	36·0

Table V shows a clear difference between the present figures and those for 1942 in the percentage of men who have had considerable operational experience, since there has been a fall of 10 per cent from 36 per cent. In contrast, the percentage who have had no operational experience has risen in the same time by 7·5 per cent from 39·1 per cent. These differences are highly reliable statistically. They may be related to the significant increase in the proportion of case which arose under training (Tables I and IV). It must be borne in mind that these figures are simply proportions which will be influenced by the number of men exposed to the possibility of neurosis. Nevertheless from all these facts it appears that there is a tendency for men who are suffering from a neurosis to reach a neuro-psychiatrist earlier in their flying career than they did previously. It also seems that the neuroses are less frequently arising as a result of operational experience. Although this comparison is a rough one, and although many factors may be responsible for such a change, we hope that the responsible factors include those which it has been our aim to foster since 1942 :—

(i) the earlier recognition of temperamentally unsuitable air crew under training ;

(ii) the more efficient prevention of neurosis in squadrons.

3. Diagnosis

TABLE VI

Reaction types recognised in the 2,989 cases of neurosis arising in the year

Reaction types	No.	Percentage of total cases	Percentage 1942 (page 123 Table IX)
Anxiety state	2,210	77·0	77·2
Hysteria	410	14·3	11·5
Depression	255	8·9	10·7
Fatigue state	124	4·3	5·8
Obsessional	45	1·6	1·3
Schizophrenic	24	0·8	1·0
Other diagnoses	5	0·2	0·4
Mixed syndromes	205*	7·3	7·4

The distribution of diagnoses in Table VI has changed so little that comment is unnecessary.

* In 57 cases the presence of a neurosis was doubtful at the time of examination, and in 59, where the man had completed less than 12 hours flying and was handicapped temperamentally, a diagnosis of unsuitable for flying duties was made. These cases have been excluded from Table VI so that the diagnoses were made upon 2,873 cases. The percentage is based upon this total. In 205 cases more than one reaction type was recognised—so that there are more reaction types than cases.

4. Causes of the neuroses

It will be seen from Table VII that in many cases the causes were multiple. In all except 34 (1·2 per cent) of these, one of the causes was thought to be psychological. The contribution of the different causes which were considered to be responsible for the neuroses shows the same order as before. Physical factors have, however, been recognised as casual in an appreciably smaller number of cases than in the preceding year. This applies especially to physical injury. This probably means that there has been a progressive tendency to place a greater emphasis upon the causal importance of psychological factors. In some cases physical factors may well have been present but considered of minor importance by the psychiatrist.

TABLE VII

Main causes of the neuroses recognised by the specialists

Causes	No.	Percentage of total*	Percentage 1942 (page 122 Table VII)
Psychological causes	2,839	98·8	99·6
Physical causes	558	19·4	29·0
Injury	275	9·5	15·2
Illness	205	7·1	9·7
Air sickness	43	1·5	2·0
Exhaustion	35	1·2	1·8
Mixed psychological and physical causes	524	18·3	29·0

* The total is 2,873 as in Table VI, for it only includes the cases where a reaction type was recognised.

Disposal of cases

In each case the neuro-psychiatrist recorded his opinion upon disposal but only the actual medical board's disposals have been accepted for the present purpose. In an appreciable number of cases the neuro-psychiatrist was unable to give this information ; in many others a disposal had not been made at the time the data were collected. Altogether, board disposals were known in 2,113 cases (70·5 per cent). The data presented below are based upon these cases.

Information upon the final disposal which had been made by a medical board was available in 1,184 of the 2,989 cases during the year under review. Of these, 392 (32·3 per cent) were returned to full flying duty, 64 (5·3 per cent) to limited flying duty, 728 (60·2 per cent) grounded, and only 26 (2·1 per cent) were invalided. It has been explained elsewhere that the number of men who ultimately return to flying duties is higher than this, for many who have a temporary category will subsequently be given a permanent flying category. It will be seen in Table VIII that the figures are very similar to those for the first six months of 1942.

TABLE VIII

Final disposal by a medical board in 1,184 of the 2,989 cases

Category	Percentage of cases with final disposal	
	1943–44	1942
Full flying	32·3	35·1
Limited flying	5·3	7·1
Grounded	60·2	55·9
Invalided	2·1	1·8

Information concerning temporary disposals given by medical boards was available in 833 instances. In 424 (50·9 per cent) of these the man was directed to limited flying duties and in 409 (49·1 per cent) to ground duties. The disposal of men temporarily grounded of course includes hospital treatment, convalescence and sick leave, as well as temporary ground duties on a station. The disposal of cases is critically examined on pages 167–170 and 239–242. Tables giving more detailed information upon data from individual Commands, in Chapters X and XVIII, have been omitted here.

References

Reid, D. D. .. .. *The prognosis for a return to full flying duties after psychological disorder.* FPRC 535 (*see* Chapter XVIII).

Symonds, C. P. & Williams, D. J... *Investigation of psychological disorders in flying personnel : statistical survey of the records for six months, 3rd February to 3rd August,* 1942. FPRC 412 (g) (*see* Chapter IX).

Clinical and statistical study of neurosis precipitated by flying duties. 1943. FPRC 547 (*see* Chapter X).

CHAPTER XII

OCCURRENCE OF NEUROSIS IN ROYAL AIR FORCE AIR CREWS IN 1944 AND 1945

by

Air Vice-Marshal Sir Charles P. Symonds, K.B.E., C.B., M.D., F.R.C.P., and
Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

FPRC Report 412(*L*) *April, 1945*

Introduction

This statistical survey of the occurrence of neurosis in flying personnel, in the year ending February 10th, 1945, is similar to that of the corresponding report for the previous year (Chapter XI), so that the data in the two reports can be easily compared. When it has seemed profitable figures for the previous year have been included for comparison. The method of collecting and assembling data is described on page 118. This chapter is confined to the cases of recognised neurosis.

1. Cases referred for psychiatric opinion

The neuro-psychiatric specialists in the R.A.F. at home and in all overseas commands submitted cards to Central Registry upon 3,453 new cases of flying personnel referred to them on account of psychological disorder during the year, made up as follows :—

Recognised neurosis	2,910
Not having a neurosis but lacking in confidence	306
Not having a neurosis but unsuitable for flying duties	108
Considered normal and returned to duty	129
All cases	3,453

The number of cases of neurosis has been stable in the past two years. Figures for the past three years were :—

	Cases of neurosis	*Cases not having neurosis but considered lacking in confidence*
1942–3	2,503	416
1943–4	2,989	307
1944–5	2,910	306

2. Distribution of cases of recognised neurosis

TABLE I
Distribution under commands

	Number of cases		Percentage of total	
	1943–4	1944–5	1943–4	1944–5
Bomber	1,022	890	34·1	30·3
Flying Training Command	969	849	32·4	29·1
Middle East	402	497	13·5	17·1
Coastal	316	264	10·6	9·1
Fighter	270	279	9·0	9·6
India	—	67	—	2·3
Other Commands	10	74	0·4	2·5
Total	2,989	2,910	100·0	100·0

The contribution of each command has remained roughly the same.

TABLE II

Distribution under operational and training units

Command	Units	
	Operational	Training
Bomber	673	207
Fighter	229	50
Coastal	181	83
Others	57	17

In the past year, as in the preceding, about a third of the cases from operational commands have arisen in training units.

TABLE III

Distribution under air crew categories

Category	Number of cases	Percentage of total	Percentage 1943–4
Pilot	1,001	34·5	35·1
Navigator	519*	17·8	19·2
Air Gunner	519	17·8	15·0
W/Op.	463†	15·9	18·4
Air Bomber	163	5·6	4·6
F/Engineer	167	5·6	4·3
P.N.B.	78	2·7	3·4

* Includes :—

Navigator	323
Navigator B., W., and B.W.	150
Navigator Radio	46
	519

† Includes :—

Wireless Operator	447
WOP/M., F.M.A.E.	16
	463

These proportions are similar to those in the previous year.

TABLE IV

Distribution under duties

Duties	Number of cases	Percentage of total duties	Percentage of total duties 1943–4
Under training	961	32·0	35·9
Night bomber	844	28·1	26·7
Instructor	262	8·7	8·6
Coastal General Reconnaissance	256	8·5	7·5
Day fighter	173	5·8	6·9
Day bomber	113	3·8	3·4
Night fighter	84	2·8	1·9
Staff	78	2·6	3·4
Ferrying	69	2·3	1·0
Coast offence	51	1·7	1·5
Coastal boats	28	0·9	1·9
Air Sea Rescue	28	0·9	0·3
Army Co-operation	22	0·7	0·7
Test pilot	19	0·6	0·2
Photographic Reconnaissance ..	17	0·6	0·2
Total duties	3,005*	100·0	100·1

* In 95 cases two successive duties, usually instructing and an operational duty, were together thought to have been responsible for the neurosis.

Table V provides a rough idea of the hours flown before breakdown occurred.

TABLE V
Distribution under flying experience

Flying experience	Number of cases	Percentage of total cases	Percentage of total 1943–4
No flying	178	6·2	7·9
No operational flying	1,012	34·7	31·2
Under 100 hours ops.	836	28·7	24·8
Over 100 hours ops.	884	30·4	36·0

It will be seen that the proportion who broke down before commencing operations has not changed materially in the past two years.

3. Diagnosis

TABLE VI
Diagnosis of reaction types

Reaction types	No. of cases	Percentage of total cases	Percentage of total 1943–4
Anxiety	2,164	74·7	77·0
Hysteria	469	16·1	14·3
Depression	289	9·9	8·9
Fatigue	99	3·4	4·3
Obsessional	47	1·6	1·6
Schizophrenic	32	1·1	0·8
Others	11	0·4	0·2
Mixed syndromes*	224	7·7	7·3

* As the number of diagnoses is greater than the number of cases—since a double diagnosis was made on 224—the total of the percentage exceeds 100.

Since we are considering neuroses only no analysis has been made of 543 cases in which the neuro-psychiatrists found no evidence of such a disorder. In 129 of these cases no evidence of any abnormality could be found and the man was returned to flying ; in 306 a diagnosis of lack of confidence was made ; and in 108 the man was considered temperamentally unsuitable for flying duties although there was no evidence of a neurosis at the time of examination. Ninety of the 108 men considered temperamentally unsuitable for flying duties came from Flying Training Command. This increases the number of men referred to the neuro-psychiatrist with symptoms of a nervous disorder in that command in the past year to 939.

TABLE VII

Main causes recognised by the specialists

Causes	No. of cases	Percentage of total cases	Percentage of total 1943–4
Psychological causes	2,864	98·4	98·8
Physical causes	516	17·7	19·4
Injury	236	8·1	9·5
Illness	212	7·3	7·1
Air sickness	38	1·3	1·5
Exhaustion	30	1·0	1·2
Mixed psychological and physical causes	499	17·1	18·3

In this table the number of causes naturally exceeds the number of cases, since in many patients more than one cause for the illness was discovered. It is obvious that there has been little change in the occurrence of the causal factors. It will be noticed that the table omits a cause for 29 cases. This is explained by the fact that in some instances, especially among the 32 schizophrenic patients included in the series, no environmental cause was recognised.

4. Disposal

Only the actual medical boards' disposals have been accepted for the purpose of appraising prognosis in this and preceding reports. This information was often unknown to the neuro-psychiatric specialist, but it is known in 1,908 instances (65·6 per cent of the total). In 841 of these cases only a temporary disposal had been given, but in 1,067 the final dispositions were known. In these 1,067 the dispositions were distributed as in Table VIII.

TABLE VIII

Disposal of cases

Category	Percentage of cases with final disposal		
	1944–5	1943–4	1942
Full flying	22·5	32·3	35·1
Limited flying	3·5	5·3	7·1
Grounded	72·1	60·2	55·9
Invalided	1·9	2·1	1·8

It will be seen that there is a tendency for the specialists to return fewer men to flying duties. As has already been explained, these figures do not indicate the percentage of all the cases ultimately returning to flying duties. Of the 841 cases in which no final disposal had been made, 376 had already been given limited flying duties temporarily and it is probable that most of these and many of the others with a temporary disposal will eventually return to flying. Nevertheless of the men given a final disposal by the end of the year, the percentage removed from flying rose from 57·7 in 1942 to 62·3 the next year and 74·0 in the year now under consideration. The reasons for this increase cannot be stated with certainty but there is no doubt that one of them has been the experience of neuro-psychiatrists that the ultimate prognosis for full flying duties in most men who have had a neurotic illness is unfavourable.

It has also been realised that there is little employment available in war for men with a limitation of flying category for neurotic disability, whether this limitation be temporary or permanent. The limitation appropriate for these cases is usually non-operational flying only. The only large-scale employment open to such men is on instructional duties and there have been several indications that they are generally unsuitable for such work owing to the effect which their uncertain behaviour may have upon pupils. Another factor may have been the impression that the number of air crew under training has been relatively higher in relation to wastage than in previous years.

For these reasons the neuro-psychiatrists have tended to select only the most favourable cases for rehabilitation for flying duties, and to advise permanent grounding earlier and more often than in the past.

References

Symonds, C. P. & Williams, D. J... *Investigation of psychological disorders in flying personnel : statistical survey of the records for six months.* 1942, FPRC 412 (g) (Chapter IX).

,, *The occurrence of neurosis in R.A.F. air crew,* 1943-1944, FPRC 412 (i) (Chapter XI).

CHAPTER XIII

TIME OF RECOGNITION OF NEUROSIS IN FLYING PERSONNEL

by

Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

FPRC 412 (j) January, 1945

In comparing the occurrence of neurosis in flying personnel in the years beginning in February, 1942 and 1943, it was evident that many more men had reached a neuro-psychiatrist while under training in 1942–43 than in 1943–44, and that fewer had been referred from squadrons (pages 119, 120). The implications of these observations were discussed, but definite conclusions could not be drawn from them as the actual incidence of neurosis under training and in squadrons was not known. Further evidence on this incidence has now become available.

By far the biggest contribution to the total number of flying personnel with neurosis was made by men under training in Flying Training Command and by men in night bomber squadrons in this country. These two duties together made up nearly half the total cases from the 15 forms of duty under which the cases are classified. As these two duties also represent the two extremes of the flying career they have been selected for comparison ; it is impracticable to ask commands for the necessary data for every duty separately.

The number of cases of neurosis which occurred in these two duties in 1942–43 and 1943–44 are shown in Table I. They include all flying personnel considered by the neuro-psychiatrist to be suffering from a neurosis. They do not include those showing no evidence of a neurosis, but considered to be lacking in confidence.

TABLE I

Duties	No. of cases of neurosis	
	1942–1943	1943–1944
Under training—Flying Training Command	520	738
Night bomber squadrons ..	682	575

The incidence of neurosis was calculated as a percentage of the average strength (obtained from the respective commands) of the air crews engaged in those duties in each of the two years. As the comparison is made between men in the same commands and duties, a figure of incidence based upon the percentage of average strength is a reasonable one. This basis does not differ greatly from that employed on page 141.

TABLE II

Duties	Percentage of average strength referred with a neurosis		
	1942–1943	1943–1944	
Under training—Flying Training Command	1·67	2·32	33·5
Night bomber squadrons . .	12·00	8·50	27·9

These tables show that there has been a significant increase in the number of men suffering from a neurosis referred for a psychiatric opinion while under training in Flying Training Command and a significant fall in the same kind of case from night bomber squadrons. It seems, therefore, that there is a tendency for men who are suffering from a neurosis to reach a neuro-psychiatrist earlier in their flying career than previously, while neuroses are less frequently arising as a result of operational experience. There is reason to believe that the incidence of neurosis in squadrons has fallen still further since D-Day, and has now reached an unusually low level, but it should be appreciated that the figures here presented relate to the two years before February, 1944, when the factors responsible for the more recent decrease were either not operating or less potent.

Summary

Facts are presented which show that there is a tendency for the men suffering from a neurosis to reach a neuro-psychiatrist earlier in their flying career than previously and that neuroses are less frequently arising as a result of operational experience.

References

Symonds, C. P. & Williams, D. J. . . *Investigation of psychological disorder in flying personnel : clinical and statistical study of neurosis precipitated by flying duties.* 1943, FPRC 547 (*see* Chapter X).

,, ... *Occurrence of neurosis in R.A.F. air crew,* 1943-1944. FPRC 412 (i), (*see* Chapter XI).

CHAPTER XIV

PREDISPOSITION TO PSYCHOLOGICAL DISORDER IN NORMAL FLYING PERSONNEL

by

Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

FPRC Report 516, February, 1943

Introduction

It is described in Chapter IX that 1,197 cases of psychological disorder in flying personnel were seen by neuro-psychiatrists in the six months February to August, 1942. Sixty-eight per cent of these showed evidences of predisposition to psychological breakdown. This figure would be more valuable if the proportion of normal flying personnel without signs of psychological disorder who were found to be similarly predisposed were known. To achieve this, a control group would have to be examined under the same conditions, using the same methods of clinical assessment and similar standards of judgment. This has been attempted.

1. Method

In the group of 1,197 patients, predisposition was assessed as follows. The patients were seen by R.A.F. neuro-psychiatrists who forwarded their individual assessment of predispoition as nil, mild, severe to the Central Registry of Psychological Disorders in Flying Personnel, with notes on the observations upon which the psychiatrist's opinion had been based. At the Registry it was noticed that there were individual differences in the standards used by the neuro-psychiatrists, depending to some extent upon their past training and present approach to the subject. Thirty-one psychiatrists made returns.

TABLE I

Assessment of different groups of unselected cases by six different specialists

		Assessment of pre-disposition (percentage)		
Observer	Cases examined	Nil	Mild	Severe
1	100	40	60	0
2	100	10	65	25
3	100	19	56	25
4	100	27	61	12
5	·100	15	56	29
6	83	33	60	7
Total	583	24	60	16

While the percentage of mildly predisposed subjects is similar in the assessments of the six psychiatrists, it will be seen that differences are present in the numbers in the severely predisposed group. The six observers found some evidence of predisposition in from 60 to 90 per cent of their cases, the average being 76 per cent. From the figures in this table it is clear that the observers did not differ so much in eliciting signs of predisposition as in grading the degree of the predisposition discovered into the two groups of mild and severe. This division is of course arbitrary and artificial, since no sharp distinction can be made between the degrees of predisposition encountered in a group of subjects. As a guide to the observers it was suggested that if predisposition was so marked that had it been recognised at the time of enlistment it would have been sufficient to warrant rejection for air crew, should be considered severe. All other cases in which there was evidence of predisposition were to be considered mildly predisposed.

The relative importance which is attached to predisposition and to environmental factors in the ætiology of neuroses varies among psychiatrists, and it might be expected that those who laid great weight upon predisposition would search for it with the greater diligence. Their assessment of predisposition as mild and severe might also be influenced to some extent by their approach to the psychiatric problem in hand. From a survey of the data at the Central Registry there is little doubt that such individual differences exist, and that one psychiatrist will elicit greater evidence than another of predisposition in a case. It might be argued that the most useful information would be derived from the clinical notes of the observer who was most successful in eliciting signs of predisposition. As it is the present purpose to compare two groups of cases, examined under similar conditions, the average assessment of the thirty-one psychiatrists in the Royal Air Force, who between them interviewed 1,197 cases, probably gives a better impression of the proportion of predisposed individuals than would data from one or two selected observers. As the control group of cases was examined by a number of neurologists and psychiatrists, the comparison is closer if the former course is adopted.

As there is an admitted disparity between the views of individual psychiatrists, they were all asked to record the clinical evidence upon which their assessment had been based in each case. Notes on these were forwarded to the Central Registry, where, on the basis of the clinical data, the individual assessments were modified where necessary, to conform to the average, so that for instance the number of patients classed as severely predisposed in 1, 4 and 6 would be raised, and in 2, 3 and 5 would be lowered.

Evidence of predisposition to neurosis was based on an account of the patient's personal story, and upon evidences of instability in near relatives. In the personal story the patient's reactions to the stresses encountered at school, in his home life, his employment and in the Service were taken into account, as well as an introspective description of his personality, including any evidences of overt psychological disorder. The personal factors ranged from nervous traits in childhood such as nail-biting or timidity, to severe affective disorder requiring medical care. In the family history the factors included obviously abnormal personality traits, neurotic illnesses and even frank psychoses. Short desciptions of the methods of assessment of predisposition to neurotic illness have already been given by Gillespie (1941) and by Symonds (1942). The standards used in this investigation may be judged by reference to the case summaries on pages 188–189.

Table II shows that over two-thirds of all men who break down are considered to be predisposed by this method of assessment, which is purely empirical and has been used arbitrarily by different workers on the tacit assumption that its validity has been established. As this assumption is at present unfounded, examination of a control group of subjects would be valuable.

TABLE II

Degree of predisposition in the whole series of 1,197 cases

	Percentage
Total predisposed	68
Evidence of mild predisposition	52
Evidence of severe predisposition	16
No evidence of predisposition	32

Material

The control series of normals consisted of a hundred flying personnel admitted consecutively to the Military Hospital (Head Injuries), Oxford, with an acute head or spinal injury resulting from a plane crash, car accident or enemy action. It included only patients admitted to the hospital in the earliest stages after the injury; and subjects with open gunshot wounds, compound fractures, or gross damage to the central nervous system. They had all been performing full flying duties efficiently and well until the time of the accident. Forty-five per cent had been on operations, 21 per cent were from O.T.Us., and 33 per cent were under training in Flying Training Command. They consequently represented a rough cross section of the Royal Air Force and were comparable with the flying personnel with psychological disorders, of whom 60 per cent had been on operations, 18 per cent were from O.T.Us. and 22 per cent were from Flying Training Command. All these normal men had been interviewed while in hospital by an Army neurologist or psychiatrist and also by Air Vice Marshal Sir Charles Symonds, or in his absence by the author, as it was necessary in each case to study the personal background and family history before advising disposal. Full data upon predisposition consistent with that obtained in the 1,197 cases with psychological disorder was therefore available in all cases. The notes were finally collected and predisposition in the control group was assessed at the Central Registry in exactly the same way, and with the same standards as for the group of cases of psychological disorder.

3. Results

TABLE III

Assessment of degree of predisposition in the series compared with that of a control group

Predisposition	100 normal flying personnel (control group)	1,197 flying personnel with psychological disorders
		(percentage)
Nil	85	32
Mild	12	52
Severe	3	16
Total predisposed ..	15	68

(a) **Mildly predisposed**

Case No. 731 : Pilot, under training, aged 19. Admitted after a plane crash. Family history : good, except that his father was described as a 'restless type of man.' Personal history : did very well at school ; was captain of the school and captain of games. Mother said that he was restless or excitable like his father, and in hospital he showed rather hypomanic behaviour.

Case No. 769 : Pilot, under training, aged 20, married. Admitted immediately after a crash landing through fuel shortage. At school he did not take matric. because he thought it did not matter, and on leaving he held a series of different jobs and could not settle down. In the R.A.F. he has been impatient at the length of training. Says he has "always had a wandering type of temperament," prefers solitude, has no close friends, and worries over things he thinks important. There was no family history of neurosis.

Case No. 888 : Pilot, under training, single, aged 19. Admitted immediately after a crash in which he sustained burns, cuts and a trivial head injury. Had a normal school life and was a clerk before joining the R.A.F. Had always been subject to mood changes which had no apparent cause, either depression lasting a few hours, up to a day or two, or of unusually high spirits of briefer duration. The mood swings were more evident after the crash, depression predominating. He was consequently removed from flying training. Mother had had two attacks of depression, not requiring treatment.

Case No. 937 : Pilot, under training, aged 23, severely injured in an air raid. Family history : seven siblings are normal but one used to sleep walk. The patient left school at 18 and had held one job since. He is subject to extreme mood changes, becoming depressed frequently since the age of 18. The attacks of severe depression have no apparent cause, occur two or three times a year and last one to two days. Normal in school and has remained well in the R.A.F. Has a violent temper and tends to be solitary.

Case No. 1063 : Flying Officer, instructor, aged 29, with 1,000 flying hours, including an operational tour, was run into by another plane, on the ground. Admitted immediately afterwards. Family history was good. Personal history : Did well at school and held the same banking job for 10 years until the war. Single, a non-smoker and teetotal. He is very shy and consequently solitary. Hardly mixes at all. Hates mixing with new people and uses subterfuges to cover his embarrassment. During his operational tour he slept badly and had nightmares of flying.

Case No. 1096 : Pilot, under training, aged 19, sustained a head injury with a lacerated scalp in a forced landing. Family history : Mother had a nervous breakdown, aged 40, as a result of air raids, but also had one 10 years previously, otherwise the history is clear. Personal history : Normal school life. Held one job before joining the R.A.F. Plays football and swims a lot and shows no neurotic traits.

Case No. 2025 : Pilot, aged 25, in nearing the end of his tour on Coastal G.R., was a passenger in a car which skidded. Had a minor head injury and returned to full flying. Family history : Says mother suffers from nerves because she has not enough to do ; always complains of pains which the family think she simulates ; never had a 'nervous breakdown' but is called neurotic. Father and sister are stable. Patient did well at school and won a scholarship to Cambridge. Subject to mild mood swings ; is easily irritated by trifles, if thwarted, or if his plans have to be changed.

Case No. 3155 : Pilot, under training, aged 19, single, with 160 flying hours. Admitted with abrasions and concussion after an air crash. He plays team games and mixes well. Has had headaches in hot weather for years and occasionally gets depressed for no apparent cause. Family history : Good, except that one sister has fainting attacks in hot weather.

Case No. 3419 : Pilot Officer, Observer, aged 21, with 250 flying hours. Admitted with an acute but slight head injury. Had an uneventful past and no abnormal traits. Played first-class Rugby. After the head injury, developed a mild anxiety state from which he recovered. One brother had a nervous breakdown lasting for several months, attributed to overworking for an examination, otherwise the family history was good.

Case No. 3477 : Pilot, single, aged 20. 100 hours operational in Stirlings. Severe head injury following crash (he was second pilot). Family history : Mother had a nervous breakdown, aged 24, but has been well ever since. Grandfather suffered from infrequent faints. Personal history : Conscientious and sensitive type, though cheerful, who did well at school, getting school certificate at 16. Went into a bank, and after six months joined the R.A.F., aged 17. Did well in flying, was keen on games and mixed well. "Operational work affected him a little, but he never allowed himself to show it."

Case No. 3534 : Pilot Officer, Observer, aged 26, 187 flying hours with 5 operational sorties in Bostons, severely injured in a crash returning from operations. Family history : Father, suffering from melancholia, has been in a mental hospital for 5 years ; not improving. No other evidence of instability in the family. Patient did well at school and in civilian employment, but his brother said that he was highly strung and inclined to stutter.

Case No. 3584 : Canadian pilot instructor with 230 hours. Admitted with an acute head injury caused by engine failure at night. Family history : Mother is nervous type of woman, who has migraine. Father drank heavily. Personal history : Did well at school and studied pharmacy afterwards. He adjusted well to Service life and to living in England. Conscientious and always worrying about something. Dreads examinations and failed the pharmacy final. Plays ice hockey and baseball. After the war he intends to take up farming "as it is a quiet life."

(b) Severely predisposed

Case No. 711 : Pilot, under training, aged 21, with 150 flying hours, sustained a severe head injury by crashing in take-off. He is an only child who did badly at school and did not get matric. till 19, he then went to the University and failed inter B.A. He had a severe depressive illness, aged 18, lasting 9 months, attributed to overwork. During this he was prevented from attempting suicide by his parents' timely intervention. His father had a similar depression 12 years ago after a period of mental strain, and his father's mother had a similar illness. In hospital after the head injury he again became depressed and had suicidal thoughts. He was consequently removed from flying.

Case No. 918 : Bomber Squadron Leader with 1,200 flying hours, who had completed an operational tour, and been awarded the D.F.C. Married. Had fallen and hit his head on a concrete floor. Family history : No evidence of nervous or mental instability, but his father was timid and irritable. The patient showed very many marked obsessional traits, and had obsessional fears while flying, although he had absolute confidence in his flying, and had no great fear of operations. His obsessional habits were severe enough to embarrass him at times and to decrease his efficiency in the air.

Case No. 4087 : Air Gunner, aged 22, married 9 months. 150 flying hours. Admitted with a very severe head injury, necessitating operation, from which he made a full recovery and returned to flying. Family history : Father went to Canada in 1920 to find work, and after a year ceased to write and has not been heard of since. His mother is slightly anxious. He is an only child. Personal history : Before joining the R.A.F. he had held over 20 jobs of all kinds, and had been dismissed for petty offences and insubordination on many occasions. Frequently put on charges as a flight mechanic, but after remustering as air gunner he seems to have found his niche, and had no further trouble.

4. Discussion

From Table III, 15 per cent of the controls and 68 per cent of the abnormal group are predisposed it follows that any member of a crew who breaks down is $4\frac{1}{2}$ times as likely to have been predisposed to psychological disorder as is his apparently normal colleague. Also from Table III it follows that evidence of predisposition sufficiently severe to warrant rejection on enlistment is over 5 times as common in those who broke down. It might be argued that the high proportion of predisposed air crew among those who broke down would warrant rejection of the 3 per cent of normals who were severely predisposed, and even perhaps of the other 12 per cent who were mildly predisposed. Symonds (1942) estimated the contribution made to the war effort by the patients showing evidence of severe and mild predisposition in 100 air crew referred to him with psychological disorders. He concluded that although the results showed that it would probably have been profitable to reject those severely predisposed on enlistment, the total contribution made to the operational effort by the mildly predisposed before they broke down amply repaid their acceptance.

Although two-thirds of those who break down are predisposed, the proportion of this sample of normal men who are predisposed, and who will also break down is not known. As the incidence of the predisposed is nearly five times as high in the abnormal group it is obvious that apparently normal predisposed men are in fact more likely to break down than their normal colleagues. The exact proportion could only be determined if the true incidence of psychological disorders were known. As all the predisposed normals are unlikely to break down it is even less likely that rejection of this group of predisposed individuals would be profitable than was the case in Symonds' series, all of whom had already broken down.

Although the exact incidence of psychological disorders in flying personnel cannot be calculated, the figures which are so far available show that the incidence is certainly less than 5 per cent, so that it is less than a third of the percentage of normals found to be predisposed. Thus, at best, for each breakdown prevented by rejection two efficient men would also be rejected. Again, one-third of those who break down show no evidence of predisposition in retrospect (Table II), so that the adverse balance against wholesale rejection of the predisposed is increased.

Against this argument must be placed Reid's evidence (1942) that the predisposed show greater accident proneness and are more likely to show inefficiency or failure in operations, so that the duration of their operational effort may be a spurious measure of its value. Some of the control group had been responsible for the accident which caused their injury, so that it may well be that the porportion of them who are predisposed is, on the basis of Reid's work, a shade higher than it would be in fully efficient flying personnel. This factor is, however, likely to be a very small one, and to have an insignificant effect upon the results presented.

It was shown at the beginning of this chapter that there are individual differences in the assessment of predisposition which are standardised at the Central Registry. Since only 100 normal men have been examined, and compared with 1,197 with psychological disorders, it would be well to compare the results obtained with those of other workers. Campbell assessed predisposition in 60 flying personnel who were surgical patients in the R.A.F. Officers' Hospital, Torquay, in the same way as has been done in this investigation. None of his patients showed signs of psychological disorder. He found 15 per cent to be mildly predisposed and 3 per cent to be severely predisposed. Unfortunately the documents upon which these observations were recorded have since been destroyed by enemy action. Reid similarly assessed predisposition in two heavy bomber squadrons on his station by means of a short informal personal interview. As he was comparing different groups of men within the squadrons, he did not claim any absolute accuracy for his method of assessment, which through necessity could not be based on a full clinical psychiatric interview. Nevertheless, he estimated that 16 per cent in one squadron and 20 per cent in the other showed some evidence of predisposition. He went on to show that the subsequent performance of those whom he considered to be predisposed was inferior to that of the rest of the squadron, since in them the operational efficiency was lower, the accident proneness greater, and the rate of psychological disorder higher. Lastly, Gillespie on the basis of a short interview of 600 men has found that 16 per cent of flying personnel under initial training show evidence of predisposition of the type described by him earlier.

All these observers may not have used identical methods in assessing predisposition, and, although the percentage of subjects considered to be predisposed by them is very similar, there is really no evidence that had they examined the same group of cases they would each have found evidences of predisposition in exactly the same individuals. Nevertheless, in many hundreds of cases of psychological disorder returns have been made to the Central Registry by more than one observer, and in these cases agreement is close. Of 300 cases in which an opinion had been given by more than one psychiatrist, there was agreement as to the presence or absence of predisposition in 75 per cent and there was absolute agreement as to the degree of predisposition—nil, mild or severe—in 58 per cent. It is consequently likely that there would be close agreement between the observers quoted in Table IV as to the actual subjects who showed predisposition.

TABLE IV

Summary of assessments of predisposition by four observers

Observer	Flying personnel	Predisposed (percentage)
Williams	100 healthy men at all stages of experience	15 (3 severe)
Campbell	60 officers in a surgical ward	18 (3 severe)
Reid	200 men in two bomber squadrons	18
Gillespie	600 aircrew entrants	16 (2·8 severe)
	960 normals .. .. .. average	16·4 (2·9 severe)
	1,197 psychological disorders	68·0 (16 severe)

These groups are obviously not strictly comparable: the present series is a rough cross-section of all flying personnel; Reid's was drawn from operational crews only; Campbell's were all officers; Gillespie's were untried entrants. In addition, the standards of assessment were those of the individual investigator. Nevertheless the proportions considered to be predisposed are all of the same order and the average of the assessments of the four workers confirms that air crew with psychological disorder are over four times as likely to show evidences of predisposition to these disorders as are normal flying personnel.

The results of this investigation consequently justify the assumption that predisposition to psychological disorders in flying personnel can be assessed by competent observers using a method of personality study based on a short interview which includes a survey of the subject's personal and family history. Although this method has been employed in the Service empirically since the outbreak of war it appears that the estimated predisposition has not previously been related to the actual liability to break-down.

This report shows that there is a direct relationship between the incidence of demonstrable traits assumed in the past to indicate predisposition to psychological disorder and the actual liability of flying personnel to these disorders. It does not necessarily follow that this method of personality selection can with benefit be directly applied to the problem of selection, since many who show evidence of predisposition will not necessarily break down during their active Service career, and some who do break down will previously have made an adequate contribution. Symonds (1942). The extent to which personality selection can implement the present methods calls for special investigation.

5. Summary and conclusions

In Chapter IX it was shown that neuro-psychiatrists in the R.A.F. considered that 68 per cent of flying personnel with psychological disorders showed evidences of predisposition to these disorders. Exactly the same methods of assessment have now been applied to 100 normals. The results obtained have been compared with those of other workers. As a result it may be concluded :—

(*a*) That the method of assessment of predisposition to psychological disorders in flying personnel used extensively by neuro-psychiatrists in the R.A.F. is capable of indicating a positive liability to these disorders.

(*b*) That approximately 15 per cent of normal flying personnel show evidence of this predisposition. In 3 per cent the predisposition is so marked that had it been recognised, it would probably have led to the candidate's rejection at enlistment.

(*c*) That upon the same standard of assessment 68 per cent of flying personnel who have developed psychological disorders show similar signs of predisposition, in 16 per cent severely. The ratio of the predisposed in normal and psychoneurotic air crew is consequently 1 to 4½.

(*d*) That this high ratio does not necessarily warrant rejection of the predisposed. The evidence available suggests that it would be uneconomical to reject any except the severely predisposed individuals—a rejection rate of 3 per cent or less.

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CHAPTER XV

SIGNS OF TEMPERAMENTAL UNSUITABILITY IN AIRCREW UNDER TRAINING

by

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Introduction

In April 1943, as the result of investigations in Flying Training Command we submitted a report on the signs of temperamental unsuitability in pilots under training. Shortly afterwards one of us (C.P.S.) visited training schools for pilots and navigators in Canada and the U.S.A. and submitted a further report (unpublished) covering stages of training which at that time were poorly represented in the United Kingdom. Subsequent discussion of these two reports with the Directorate of Flying Training led to the Medical Directorate issuing in June 1943, a brief memorandum entitled *Notes for Instructors on the Recognition of Nervousness in Pilots* to all instructors and instructors under training at home and abroad. The two reports are now re-edited and combined into one for this volume. The memorandum is reproduced as an appendix.

The possibility of the better elimination during training of men likely for temperamental reasons to break down under the stress of operations followed the conclusion that of all flying personnel who have been seen by a neuro-psychiatrist on account of psychological disorder 16 per cent are so severely predisposed to neurosis that, in the opinion of the specialists who saw them, they might have been rejected on entry (page 121). The number of men with this degree of predisposition in the total population of flying personnel is probably not higher than 3 per cent (page 189), but Symonds (page 29) has shown that it would probably be profitable to reject these men on entry, since if they break down, their contribution to the war effort is not worth the man hours spent in their training. There are, moreover, other important reasons rejecting these predisposed individuals, which include the harm they do in affecting the morale of others, and the wastage of operational effort which may result from the inefficiency of a single heavily predisposed member of air crew (page 35). The possibility of eliminating these men on entry has already been considered. As matters stand at present it must be recognised that among the men accepted as air crews there will be a proportion—about 3 per cent—who are severely predisposed to breakdown, and in addition a larger number, about 12 to 15 per cent, who are also predisposed but not so severely as to warrant rejection.

In the analysis of men who had broken down, it was found (pages 164–166) that predisposition generally took the form either of a tendency to develop excessive fear reactions to the anticipation or reality of danger, or unusual difficulty in controlling or enduring such reactions. Predisposition of the severe degree appeared progressively less as a cause of break-down as flying experience and flying stress increased. The conclusion drawn was that there was a tendency for those with severe predisposition to break down during training, leaving those with less predisposition to break down, if at all, under the greater stress of operations, the most important factors throughout the whole series being either timidity or danger. If this assumption is true there should be opportunity for making use of the relatively slight dangers of flying training to detect excessive timidity, thus bringing to light and eliminating the predisposed.

That a liability to excessive or uncontrollable fear may be brought out in training and recognised by instructors is shown in an analysis of the instructors' reasons for rejection in a sample of 100 pilots of the American Army Air Force who had graduated from Advanced Flying Schools but were reclassified (suspended) at Operational Tactical Units. The analysis made by psychologists broke down the causes for suspension into 20 categories grouped under the headings :—

Intelligence and judgment.
Alertness and observation.
Co-ordination and technique.
Personality and temperament.

It was found that factors coming under temperament were mentioned with much greater frequency than any other reasons as the primary cause for suspension. The following table taken from the American report shows the relative importance of excessive fear :

Combinations of reasons for reclassification

Reasons	*Cases*
Fear or other personality, temperament or interest characteristics without mention of other deficiencies	36
Fear or other personality traits, plus lack of proficiency in flying	29
Fear or other personality traits, plus lack of proficiency in flying, plus defective intellectual or perceptual ability	21
Lack of proficiency in flying without mention of other deficiencies ..	6
Lack of proficiency in flying, plus defects of intellectual and/or perceptual ability, without personality defects	8
Total	100

1. Method

In the course of visits to training schools, 93 flying instructors (all having at least 1,000 hours of experience in flying instruction) were separately interviewed, the time allowed for the interview being half an hour. Seventeen officers with comparable experience of instructing at Air Navigation Schools were interrogated in the same way. Each instructor was first asked whether he considered that among the pupils graduating from the schools there were any who were so nervous that they were unlikely to succeed in the operational task. The next question put was whether the instructor should be able to detect nervousness of this kind and degree. Most of them said that they could do so, but had difficulty in describing the exact signs upon which their impression was based. It was evident that they usually formed a total impression in much the same way as does the experienced physician, but they had not had occasion to define their diagnostic principles in the same way as the physician has been obliged to do. By careful questioning it was possible in most of the interviews to obtain information upon the ways in which this impression was built up. The observations were then pooled, and the material subdivided under headings.

2. Results

The 93 flying instructors with very few exceptions considered that among the pilots who graduated were some so nervous, apprehensive or timid that they were unlikely to succeed. Their opinion was usually based upon the memory of individual cases which were quoted. Instructors with operational experience were usually the most emphatic in their opinions. A few instructors had verified their impressions by following up the careers of certain pupils. Many regretted the lack of opportunities for such follow-up. Independent estimates of the incidence of temperamental unsuitability among graduates, spontaneously offered, varied from 1 to 5 per cent.

3. Signs of nervousness in pilots

It was evident that some instructors believed that they could detect the nervous pupil but had made no attempt to analyse their impressions; others relied on a few special features which they had come to recognise as of importance individually, though not always agreeing with one another in what they thought was important; others had made use of their experience to provide themselves with a comprehensive list of questions they would ask themselves about a pupil whose temperamental suitability was in doubt. Their observations fall naturally under two headings: behaviour in the air and behaviour on the ground.

(a) Behaviour in the air

This was considered to provide the most important evidence.

(i) *Direct observation.*—Nervousness may be noticed in a man's facial expression, posture and movements, or speech, in relation to exercises or situations which contain real or imaginary danger. If the face can be seen it is the most valuable guide. One can tell from the expression whether the man is relaxed, comfortable, looking round, taking things in, enjoying his aerobatics; and notice such things as closing the eyes when aerobatted, clenching the teeth, gasping, holding the breath, apprehensive look round, or a set, strained or anxious expression. A man may show nervousness in posture or movements: shrinking into the cockpit; holding himself away from a spin; or actually holding on to the side of the aircraft. A general attitude of bodily tension was also mentioned. A few instructors took notice of excited or incoherent speech or a strained tone in the voice. Tremor, fidgeting and unjustified sweating were also mentioned. It was generally held that direct observation was much easier when sitting by the side of the pupil, as in an Oxford, and that in tandem-seated aircraft full use should be made of the mirror. It is difficult to watch the man's expression if he is wearing goggles, but neither in aircraft used for elementary training overseas which are fitted with hoods nor in the Harvards at Service Flying Training School are goggles usually worn.

(ii) *Handling the controls.*—The nervous man is inclined to be tense, holding the stick tightly and moving the rudder bar jerkily and uncertainly. This shows up early in training during mild aerobatics and on landing. Tightness on the controls was commented upon by a quarter of the instructors, some saying that the man tries to hold himself in the aircraft by the stick, and that through hanging on, when he is asked to move the controls he does so jerkily and erratically. This tenseness may be induced by doing tight turns, and it may be so evident that the instructor has physical difficulty in overcoming it.

(iii) *Flying performance.*—The information given under this heading naturally varied with the stage of training with which the instructor was concerned. At Grading School it was remarked that the timid, apprehensive man failed to use the rudder bar properly, lacking the confidence to do what he was told and showing hesitation and uncertainty. The nervous pupil in the early stages of his training is loth to take over the controls, especially when trying a new manœuvre ; has to be asked twice and encouraged and finally carries it out in a half-hearted manner. He will ask unnecessary questions and when given the answers hasn't the confidence to put them into practice. In the later stages of training the sign of nervousness most frequently mentioned in this connection was hesitation in the commencement of a dangerous manœuvre and hurry in coming out of it. The manœuvre of choice for the detection of nervousness was a spin in the Harvard or a stall in the Oxford. The nervous man, instead of putting his aircraft firmly into a spin, will delay matters until it has got to go, and will be reluctant to continue spinning for the prescribed number of turns. He will put the Oxford into a stall as gently as he can and begin to correct at once. Similar reluctance may be seen in doing steep turns, in aerobatics and in low flying : the pupil when told to take over at once starting to climb, or when told to do a forced landing from 200 feet suggesting that he should first gain some height. Erratic flying immediately after a spell of aerobatics or low flying is another sign of nervousness. The nervous man, though usually proficient, may make silly mistakes. Failure to make the expected degree of progess in a man who is neither clumsy nor unintelligent should arouse suspicion of nervousness, especially if there is failure to learn aerobatics. It is sometimes possible to conclude that a man has not been practising his solo aerobatics as instructed. Failure of the pupil to take in instruction during aerobatics is often a sign. 'The pupil who is nervous because of fear will be preoccupied and ask you what you said.' In general, the response to unexpected or difficult situations is likely to show nervousness. One instructor put it : "One should be testing the man's ability to think methodically and clearly in situations containing an element of danger."

(iv) *Evasion of exercises.*—Many instructors said that some men showed their timidity in trying to evade their flying training. There are several ways in which they do so. They make excuses for not taking-off, saying their equipment and clothing is faulty or mislaid, or that they cannot find the right maps. They may be late for instruction or ask for its delay. When they do go up they come back early, making excuses that their engine was faulty, they mistook the time, had completed the exercise, were tired or had physical complaints. The instructor may notice that they did not carry out the prescribed exercises at the Elementary Flying Training School, and some make a point of assigning a particular part of the sky to a doubtful man so that they can keep their eye on him from the ground. The man may say that he has completed his prescribed aerobatics but from his performance on testing afterwards he obviously cannot have practised them. When flying with an instructor he does the minimum number of manœuvres, or even asks to be excused them. A man will sometimes even deliberately fail his examinations, or feign backwardness in flying to escape from it.

(b) Behaviour on the ground

(i) *Request to cease training.*—It is unusual for a man to ask to be taken off flying duties with a frank admission of nervousness, but many instructors had had experience of such cases. They observed that this would sometimes develop in the course of a confidential talk with a pupil showing lack of aptitude, who, when given a lead, would admit to lack of enthusiasm, nervousness, or actual distaste for flying. The general opinion was that these men should discontinue training immediately.

(ii) *Lack of keenness* for flying is shown by absence of the normal amount of curiosity both before and after flights. The nervous man does not look for opportunities for more flying. Instead of hanging about on the chance of an extra flight it will be noticed that he is out of sight and difficult to find on these occasions. A man who is boisterous in the crew room may suddenly go quiet after he has been told to spin solo. He may spend unnecessary time on the ground before take-off, especially in instrument flying, or complain unnecessarily of minor defects in the aircraft.

(iii) *Reporting sick repeatedly.*—The nervous man or the man lacking keenness to fly may report sick repeatedly with trivial complaints such as headache, colds, or pains in the stomach. Sometimes unusual concern is shown about air sickness of minor degree. These complaints may be due to a genuine physical abnormality, or directly produced by the man's anxiety about flying, but any man whose flying training is repeatedly interrupted by frequent visits to the medical officer should be suspect.

4. Method of investigation in cases of suspected nervousness

All instructors were asked what steps they would take, if the suspicion of nervousness had been aroused, to investigate the matter further. Their replies showed that with a very few exceptions they had practical methods available. The general principle was to fly with the man and put him into situations containing an element of danger. A minority were in favour of a preliminary interview with the purpose of enquiring into the man's attitude towards flying. Others emphasised the necessity of making the test appear routine and would ask no questions beforehand, not wishing to make the man self-conscious. Many of them stressed the importance of deciding whether a man's nervousness was due to faulty instruction. For this reason they thought it would be necessary to do some ordinary flying with the pupil before embarking on any special test. The nature of the tests recommended naturally varied with the stage of training and the type of aircraft. At Grading Elementary Flying Training Schools the man's response to a simple command may give a lead to his attitude to flying. Before any instruction a man may be asked to try to fly straight and level towards a cloud on the horizon. A little later he may be asked to copy a steep turn or to correct from it. After about six hours he may be asked if he would like to be aerobatted. If the man says he would rather not, or would like to leave it over till to-morrow, if he makes no reasonable sort of attempt at the manœuvre, or if in the mirror or by the feel of the controls he is found to be tensed up and very apprehensive, he is showing signs of nervousness. The good average man will accept these situations as steps in his training. Many instructors remarked that at first many men have difficulty in absorbing instructions due to their preoccupation with their new experiences, but that after a few hours they get used to flying and learn readily. Other pupils are persistently preoccupied with their fear, however, and they show this in the irresponse to instruction, replies to questions and failure to learn. These men are especially likely to fail to attend to instruction on turning, stalling or spinning. The following are examples of special manœuvres stated by instructors to be of value in eliciting timidity in the face of stress. As one of them remarked : " What you look out for is how the man reacts to the stimulus, whether he dislikes it, and if he persists in spite of disliking it." Take the man to a strange airfield and suddenly ask him to land, or tell him suddenly when coming in to land to open up and go round again as if there were some danger or obstruction ; cut his throttle for a forced landing ; give him a snap forced landing from low altitude ; at the end of a series of aerobatics or steep turns put the aircraft into an unusual position and ask him to take control ; give him turns at low altitude when nervousness will show up in bad turns at this height in contrast to his ordinary performance ; take him up under the hood into cloud, uncover the hood without telling him he's in cloud and watch his face and whether he at once proceeds to fly on instruments ; in a Harvard put him into a spin and give him the controls, or tell him to do spins, ending with an order to do a spin off a steep turn and hold it for six turns ; in an Oxford put him into awkward stalls, or cut one engine without warning.

It is not to be supposed that the instructors recommended a battery of such tests. Each instructor had his own one or two methods which he would employ when he wanted to elicit nervousness in a doubtful case. There was general agreement that any one of the tests mentioned might provoke a nervous reaction in normal men but it was thought that the experienced instructor should know how the normal man would react.

5. Difficulties in the detection or elimination of the temperamentally unsuitable

Many instructors volunteered information under this heading.

(*a*) *Lack of experienced instructors.*—The major difficulty in detection was generally considered to be the dearth of fully experienced instructors. Inexperienced men were unreliable observers because they were a good deal preoccupied with their own flying difficulties, were often at fault in their interpretation of behaviour, and sometimes themselves responsible for lack of confidence in their pupils.

(*b*) *Insufficient opportunity for observation.*—At the Grading School and to a lesser extent at the Advanced Flying Unit the length of time a pupil remains under observation is short ; the pupil does not always continue with the same instructor and opportunities for personal contact are limited by the pressure of work.

(*c*) *Different kinds of nervousness.*—There is a difficulty in distinguishing between the nervousness of the man who is over-anxious to succeed and that due to timidity. The former was considered to be much commoner than the latter and the symptoms might appear the same to all but the very experienced and critical observer. Examination funk often confused the issue at the first air test : more than one such test by the same observer would therefore usually be necessary. When timidity is discovered it is not always easy to decide whether it is present in excess. Some instructors of great experience state that nearly all men are frightened of the air at certain phases of their training and therefore temporary loss of confidence is not uncommon. As evidence of this, if one man in a course volunteers that he is nervous and asks to cease training two or three others may do the same in the next few days, whereas in most courses there are no such cases at all. Most of these men are going through what may be regarded as a normal phase in which they have either lost confidence or failed to acquire it, not because of excessive timidity, but in the ordinary run of training. Excessive fear reactions therefore must be judged critically in relation to the stage of training, the quality of instruction, and any special incident which has shaken confidence. In spite of these difficulties it was considered possible by almost all instructors to recognise excessive timidity by the methods already described.

(*d*) *Inadequate mirrors.*—Nearly all instructors in single-engined aircraft stressed the value of the mirror for observation of posture and movement as well as facial expression ; several complained about the supply or quality of what they considered to be an essential instrument for instruction. The Manager of an Elementary Flying Training School said that mirrors were not fitted to all the Moths and those which he purchased himself were unsatisfactory.

Other instructors at the same school complained that the mirror on Moths was badly placed, and liable to excessive vibration, comparing it unfavourably with the solid, built-in mirror of the Stearman which they had been using. Some criticism of the same kind was heard of the mirror on the Harvard.

(*e*) *Limitation of stress.*—Several instructors complained that there was not enough stress in training to elicit nervous reactions. This was partly ascribed to favourable weather conditions and in the case of Moths to the foolproof nature of the aircraft. They also criticised a policy which they said valued a low crash rate in a school more than the quality of its graduates. It was considered that there should be less limitation in such matters as the steepness of turns, flying in bad weather, or night flying.

(*f*) *Quantity versus quality of graduates.*—Instructors were under the impression that the trend of present policy was in favour of quantity rather than quality. It was said that the natural reluctance of station commanders to have wastages discouraged instructors from mentioning nervousness. One Station Commander considered it important that neither he nor the Chief Flying Instructor should be held in blame for the detection of temperamental unsuitability late in the course : it might have taken that time to bring it out.

(*g*) *Difficulty in failing temperamentally unsuitable men* was emphasised by a quarter of the instructors at Service Flying Training Schools. One (Harvards) said : " It is extremely difficult to discontinue a pupil for temperamental unsuitability because the rules and regulations relate to flying ability only. I have on several occasions put men up for rejection, but they have been put through because they have been proved able to handle the machine ". A Chief Flying Instructor (Oxfords) said that there were no instructions under which he could get rid of a man who was temperamentally unsuitable. He thought there was about one man in each course of this type who got through because he could not be turned down under existing regulations. The other opinions were comparable.

(*h*) *Lack of opportunity for following up pupils.*— A few instructors at Service Flying Training Schools said it was impossible for them to check their assessments of temperamental suitability for operations without follow-up reports. They suggested that these should be forthcoming from A.F.Us., O.T.Us. and operational units.

6. Guidance for Instructors

Many of the instructors questioned volunteered the wish that some guidance should be given to them in the detection of temperamental unsuitability. This would be especially useful in the education of junior instructors. They considered that such guidance should include specific instructions for the detection of nervousness and lack of keenness at the Elementary and Service Flying Training Schools on the lines indicated above.

7. Signs of nervousness in navigators

It was generally acknowledged that men passed through the schools who were unlikely to prove temperamentally suitable for operations. Some had no heart for the job and had chosen flying for the rank ; some found themselves persistently frightened in the air ; others found the prospect of operations too much for them after getting married. Independent estimates by three instructors put the number of these men at between 2 and 4 per cent. The suspicion of nervousness might be aroused in the following ways :—

(*a*) Lack of ability to do work in the air which could be done easily on the ground was most commonly mentioned. If a man's work on the ground was very fair, and if in the air he became flustered so that his work fell off and the discrepancy was persistent (more so if it was progressive), there was ground for suspecting timidity. A good plan was to check up the logs and see if men made mistakes in the air in work they could do on the ground without thinking. Allowance had to be made for a certain amount of natural anxiety to be correct in the air, which caused some men to work more slowly.

(*b*) Occasionally behaviour in the air might indicate timidity ; for example hanging on to the aircraft as soon as it left the ground ; persistent back-seat-driver behaviour such as looking out instead of doing the job ; holding himself in when landing to avert the expected shock ; a tendency to flap in any kind of situation which might involve danger, such as getting lost, or in night flying, or to panic in changing over the petrol tanks if the engine coughs.

(*c*) Apart from an actual request to cease training, which was rare, reluctance to continue might be shown by a man's frequently reporting sick, or in some cases failing in his examinations so unexpectedly as to arouse the suspicion of intent to do so.

One-third of instructors used methods of their own for investigating a suspicion of temperamental unsuitability in navigators, attempting to suggest a dangerous situation in the air by telling the man that one of the engines was unreliable and he must do his map reading carefully, getting him lost, or cutting an engine. Most of them would fly with the man personally on such a test to observe his reactions ; one made use of a reliable staff pilot to avoid the complicating factor of examination funk. (In Air Navigation Schools the instructor rarely has an opportunity to fly with pupils.) Two instructors, if they suspected nervousness, would in the course of conversation suggest to the man that he might not pass the navigator's course and discover what his attitude would be to remustering for other air crew duties.

Difficulties in the detection and elimination of temperamentally unsuitable pupils were discussed by the majority. The first difficulty in detection arose from lack of opportunity for observing men in the air. It was stated that the instructor probably did not sit alongside the pupil in the air more than once during the course. He had therefore to depend upon the routine reports of staff pilots, which were generally regarded as of little value. The second difficulty was that actual situations which offered a chance of observing a man's reactions to danger were extremely rare. It was most unlikely that the instructor would ever have a chance of seeing the man under adverse conditions. For these reasons latent timidity might never be brought out, or if it were, might not be noticed. A man who was dead afraid in the air could in the ordinary way pass through an Air Navigation School without being suspected. Another difficulty was that of distinguishing between the nervousness of timidity and anxiety to succeed. Owing to the paucity of tests it was generally difficult to prove temperamental unsuitability, except by the man's own admissions. A Chief Instructor complained that there were no grounds for failing a man because of temperamental unsuitability, and that this was why some got through. He thought that a Chief Instructor should have authority to fail a man on this account.

8. Discussion

It is evident that in flying training the more experienced instructors, and especially those with operational experience, recognise that among those at present graduating from the schools there is a small number who are temperamentally unsuitable for the job for which they are being trained, on account of excessive or uncontrollable fear reactions. This corresponds with the clinical observations quoted in the introduction to this report. Individual instructors have their own reasons for suspecting timidity and their own methods for investigating cases under suspicion. Their experience and ideas might usefully be crystallised in the form of a memorandum for guidance to all instructors on this subject. This would need to be supplemented by verbal advice. Some of the difficulties in the way of detecting temperamental unsuitability seem to be inherent in the problems, others remediable. As one practical measure, an adequate supply of suitable mirrors should be ensured for training aircraft.

The judgment and confidence of instructors in recognising the temperamentally unsuitable would gain if they could learn which of their graduates had subsequently failed for temperamental reasons. This might possibly be achieved by the preparation of a monthly nominal roll of all cases of lack of confidence, neurosis, or cessation of training from Advanced Flying Units, Operational Training Units and operational units in the United Kingdom, circulated confidentially to training units in Canada and the U.S.A. Measures of policy which deserve consideration are insistence upon the importance of quality rather than quantity of graduates and provision of simpler means of eliminating men on grounds of temperamental unsuitability alone.

Conversation with senior instructors revealed in them a healthy bias towards optimism in cases exhibiting timidity, their first concern being to build up confidence in need of repair. Their awareness of the other aspect of the problem and their balanced view of its proportions warrants the conclusion that they could look after the elimination of the temperamentally unsuitable without any confusion of aim. The education of junior instructors in this matter would probably be best left to their senior instructors by word of mouth, any written memorandum being directed primarily to flight commanders. The reference of cases for neuro-psychiatric opinion raises two issues of practical importance. The first is the possibility of harm to the pupil whose lack of confidence is transient. There is no doubt that this exists and that unless a substantial proportion of the cases so referred (for example 50 per cent.) proved suitable for elimination, the plan might cost more than it was worth. The second is the difficulty of providing neuro-psychiatrists with suitable experience to be available for schools in Canada and the U.S.A. In the latter, except at Pensacola where provision is already made, this would at present be impossible. In Canada, Service neuro-psychiatrists are available at Regina and Toronto and their procedure could be brought into line with R.A.F. experience if an experienced man were sent over to guide them for a period of three months. The provision for neuro-psychiatric reference, though not an essential part of any plan for the better elimination of the temperamentally unsuitable by instructors, should be of value in assisting them with doubtful cases and in helping them to profit from their experience.

Instructors at Air Navigation Schools evidently believe that a certain number of their graduates are temperamentally unsuitable for operations, but their opinions are less well founded and their criteria fewer and weaker than at Flying Training Schools. This is mainly due to lack of opportunity both for testing and observing reactions to danger. More use might possibly be made of the staff pilot for observation, a question being included in the pro-forma report made on each flight asking for information upon the pupil's reaction to any emergency; and it might be of advantage to allow Chief Instructors to recommend pupils for elimination on grounds of temperamental unsuitability alone, but the difficulties in detecting and eliminating the unsuitable navigator during training are likely to remain much greater than for pilots. It would appear therefore all the more important that in the selection of navigators at intake the most careful attention should be given to temperamental suitability.

9. Summary

(1) It has been shown in previous reports that predisposition plays an important part in the causation of neurosis in air crew and that the most common factor in this is excessive timidity. This is true of neurosis occurring during training. Evidence is presented from a recent American report to show that timidity may be an important reason for elimination during training, apart from the occurrence of neurosis.

(2) Signs of timidity or nervousness as observed during the training of pilots and navigators by over 100 experienced Instructors have been described and discussed.

(3) Suggestions are made of measures which might be taken to improve the present means of eliminating from training members of air crews who are temperamentally unsuitable for operational flying and therefore likely to break down or fail under stress.

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APPENDIX TO CHAPTER XV

NOTES FOR FLYING INSTRUCTORS ON RECOGNITION OF NERVOUSNESS IN PILOTS UNDER TRAINING

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Introduction

Before men are accepted for training, they are interviewed by general duties and medical officers who reject any who seem unsuitable for flying duties. It is impossible, however, to eliminate all who are unsuitable by means of an interview. There are some signs of unsuitability which only appear during training. We are not concerned here with men who fail to make progress because of lack of intelligence or skill, but with those who are fundamentally timid and nervous. Such qualities may not have been apparent in civil life because they were never put to the test. In the course of training a man has to accept new risks. Most pupils take these for granted, and savour each new experience, whether of the first solo, aerobatics, night flying or conversion to operational types with a certain relish. Most men have some qualms before a new experience of this kind, but are able to take their training in their stride, progressing from one stage to the next without persistent nervousness and without loss of keenness for their job, but each course may contain one or two who are below the normal standard, and carry on with a struggle or evade duties which contain an element of danger. Most of these men prove a bad investment since they are unlikely to stay the course when they reach their squadrons. In addition, they may have a bad effect upon the morale of others.

A careful enquiry at all stages of training has shown that it is generally possible to recognise these individuals and that the Instructor who is with the man in the air is in the best position to do so. Provision is made in the first column of paragraph 14 of Form 5019 for reporting such faults, and it should be recognised that they may be present in a man who is in other respects satisfactory. In order to detect them the instructor must be methodical in his observations. These are the methods which are generally used.

1. Behaviour in the air

(*a*) *Direct observation.*—Nervousness may be noticed in a man's facial expression and the ways in which he holds himself and moves in relation to exercises which contain real or imaginary danger. If his face can be seen it is the most valuable guide. One can tell from the expression whether the man is relaxed, comfortable, looking around, taking things in, enjoying his experiences; and notice such things as closing the eyes when aerobated; clenching the teeth, gasping, holding the breath, apprehensive looking round, or a set, strained or anxious expression. A man may show nervousness in his posture and movements, shrinking into the cockpit, holding himself away from a spin, or actually holding on to the side of the aircraft. Direct observation is easier in twins. Full use should be made of the mirror in the tandem seated aircraft. Remember the symptoms must be of unusual degree or persistence to be considered seriously (*see* paragraph 3).

(b) Flying performance

(i) In *routine flying* the nervous man shows hesitation in the commencement of a dangerous manoeuvre and hurry in coming out of it. Instead of putting his aircraft firmly into a spin he will delay matters until it has got to go and will be reluctant to continue spinning for the prescribed number of turns. He will put a twin into a stall as gently as he can and begin to correct at once. Similar reluctance may be seen in low flying, the pupil when told to take over at once starting to climb. The same tendency may be noticed in steep turns and aerobatics. Erratic flying immediately after a spell of aerobatics or low flying, may show that the man has been feeling unduly nervous during these manoeuvres. Silly mistakes in flying made by a man who is usually proficient are sometimes evidence of nervousness. Failure to make the expected degree of progress in a man who is neither clumsy nor unintelligent should arouse the suspicion of nervousness especially if there is failure to learn aerobatics. It is sometimes possible to conclude that a man has not been practising his solo aerobatics when told to. Inability to grasp what is said to him during exercises which contain an element of danger may be due not to dullness but to preoccupation with fear.

(ii) In *looking for evidence* of undue nervousness in flying the instructor should be testing the pupil's ability to think methodically and clearly in situations containing an element of danger, e.g., shut the engine off suddenly in simulation of a forced landing and note the reactions. Don't be too drastic, for anyone can be frightened if you try hard enough, even yourself.

2. Behaviour on the ground

Apart from the small number of men who volunteer or admit that they are frightened, there are those who betray their nervousness by their behaviour. Lack of keenness for flying is shown by absence of the normal amount of curiosity both before and after flights. The nervous man does not look for opportunities for more flying. Instead of hanging about on the chance of an extra flight it will be noticed that he is out of sight and difficult to find on these occasions. He may show a persistent tendency not to stay in the air as long as he has been told, or to spend unnecessary time on the ground before take-off, especially in instrument flying. Reluctance to fly may be shown in frequent complaints of minor defects in the aircraft. Reporting sick with exaggerated concern about minor ailments or air sickness is another sign : when a man's training is frequently interrupted by visits to sick quarters, the medical officer will be able to say whether there is adequate reason for this or whether he suspects nervousness as the cause.

3. Difficulties encountered in the assessment of nervousness

Up to a point nervousness is harmless and natural. Most men are frightened at the prospect of taking risks of which they have had no previous experience. Many are not so much afraid of danger as of failure to satisfy their instructors. These kinds of nervousness, if not excessive, may be of value in stimulating a man's wits and sharpening his judgment. The ordinary man as the result of experience overcomes his nervousness and without undue effort progresses from one stage of his training to the next, ready for the stage in front of him. This progress usually has its ups and downs. Many men pass through temporary phases of lack of confidence owing to some episode by which they have been shaken, or slowness in obtaining a sense of mastery of the aircraft. These men need to be understood (often best without remark) and encouraged. It is only when nervousness is persistent and without apparent cause that it is to be regarded as a reason for suspension. It must, however, be realised that among the men who do well enough in other respects to pass, there are a few who are so handicapped by nervousness that they will never succeed in operations even if they try their best, and that paragraph 14, Form 5019, contains headings which provide for their suspension.

CHAPTER XVI

ASSESSMENT OF TEMPERAMENT IN CONNECTION WITH SELECTION OF AIR CREWS

THE PSYCHIATRIC METHOD EMPLOYED

by

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Introduction

The Flying Personnel Research Committee initiated an experiment under the direction of a Sub-Committee on Assessment of Temperament in Connection with Selection of Air Crews, the ultimate aim of which was to detect temperamental unsuitability for operations. The experiment is in two parts—first, the assessment by psychiatrists and psychologists independently of a large group of pilots who had completed their preliminary training and, second, a detailed follow-up of these men through their more advanced training and throughout an operational tour. The first part of the experiment has been completed and the psychiatric assessment extended to include a number of pilots who had already completed an operational tour. It is possible, therefore, to give a full account of the methods employed, and some results which suggest lines along which these methods might profitably be developed. The report relates, it will be noted, only to the psychiatric part of the investigation.

1. Form of investigation

(*a*) Material

Two groups of subjects were examined :—

(i) One thousand and nine pilots under training, after completion of Service Flying Training School training, at the Personnel Reception Centre, Harrogate.

(Though desirable, it was impracticable to examine a group of men who had not commenced flying training owing to the very long time that would have to elapse between preliminary assessment and results of operational work.)

(ii) Three hundred and thirty-five tour-expired night bomber pilot Instructors at O.T.U. and H.C.U. chosen at random.

The two groups of subjects were, therefore, differentiated by the fact that the first had not yet begun advanced flying and operational training, while the second had completed a full tour of operational flying. The first group were men returning from twin-engined Service Flying Training School abroad and were representative of the total population of graduated twin-engined Service Flying Training School pilots. The second group was taken to represent the total population of tour-expired night bomber pilots. For the latter purpose, since selection may take place within Groups, a proportion were taken from O.T.Us. selected at random, and a smaller proportion, representing the ratio in the whole Command, from H.C.Us.

(b) **Examiners**

Two representative psychiatrists were selected from the neuro-psychiatric service of the Royal Air Force—Wing Commander James Flind, M.D., D.P.M.,* and Squadron Leader Bernard Cates, M.B., D.P.M. ; each examined half the cases.

	W/Cdr. Flind	S/Ldr. Cates
Harrogate (graduated)	504	505
O.T.U. and H.C.U. (tour-expired) ..	169	166
Total	673	671

2. **Psychiatric method**

The method as laid down by the Committee on Assessment of Temperament of the Flying Personnel Research Committee was :—

> To carry out a psychiatric interview, lasting approximately three-quarters of an hour on each candidate, consisting essentially of a life history taken along the customary psychiatric lines. It is not a questionnaire, but an attempt to get the individual to recount his history in such a way as to bring out naturally the kind of characteristics that are considered in the light of general psychiatric experience and of war experience, on the one hand to make break-down in flying or some form of failure from psychological reasons more likely, and on the other hand, to counter-balance any tendency of that kind. Enquiries are directed to the record at school and at work afterwards, both as regards achievement and perseverance, including persistence in the face of difficulties. The survey naturally covers achievement at games, and pays special attention to the reasons why particular games may have been avoided or given up, and to the type of game and spare-time interest preferred. The social qualities of the candidates are judged on the basis of such things as membership of clubs, captaincy and so on. The health record of the candidate is gone into in some detail, from an early age, and certain aspects of temperament which are thought to bear on capacity to fly and fight successfully are assessed. Some enquiry also is made into the family history as regards illness in general, with special reference to anything suggesting a psychological type of ill-health, which often disguises itself as various forms of physical illness, the training of the psychiatrist making him able to recognise the true nature of the condition underneath its physical appearance.

Psychiatric interview (*pro forma*)

Name : Number : Rank : Age : Date :

Crew category :

1. *Predisposition.*—NIL SLIGHT MODERATE SEVERE
   (Delete the degrees of predisposition which are not applicable.)
2. Tick each of the headings which refer to any predisposition found in this case.
   (i) Family history.
   (ii) Previous nervous breakdown.
   (iii) Morbid fears : anxiety.
   (iv) Physiological instability.
   (v) Timidity.
   (vi) Lack of aggressiveness.
   (vii) Lack of persistence.
   (viii) Affective lability.
   (ix) Obsessional.
   (x) Psychological immaturity.
3. In the space provided below
   (a) Give the evidence for each positive finding, indicating the heading to which each item of evidence belongs by its number.
   (b) State the reasons for which you assign the particular degree of predisposition, with special reference to any factors which counter-balance items ticked off as positive under 2.

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*Owing to posting overseas Wing Commander Flind was unable to complete the interrogation of tour-expired pilots, so the last 38 of his series of cases were seen by Wing Commander Denis J. Williams.

It will be observed that considerable latitude was given to the observers to adopt any psychiatric approach which they thought most suitable, but they were instructed to base their assessment upon the man's life story only up to time commencing flying training. There seemed no way of withholding the subsequent life story from the observers, although this would obviously have been desirable for purposes of comparison between the two groups. Nevertheless in their examination of the group who had completed a tour the psychiatrists made it their object to frame the interview as if the man were attending for his initial examination at entry and to disregard known performance in making their assessment.

The ten groups of personality traits were based upon an analysis by Gillespie (1941 and 1944) of features observed in flying personnel who had developed neurosis. From this it was concluded that a point score obtained by giving a positive mark for each item of a schedule of unfavourable characteristics, might, as part of an interview in the hands of an experienced psychiatrist, be of significant value in assessing the probability of break-down under Service conditions. This conclusion was, however, qualified by the reservation that there was evidence of other factors of a positive or counterbalancing kind which in exceptional cases might result in a successful adaptation to war flying by men with considerable degree of predisposition as ascertained by this method. The limitation of the number of traits to ten for purposes of this experiment was dictated by the need to give the observers time to take the routine psychiatric history in an interview restricted to three-quarters of an hour. For the same reason they were not asked for any schedule of counterbalancing traits.

3. Results

(a) Psychiatric assessment

The results of the psychiatric assessment of the two groups are shown in Table I. The probability of the differences in these two contrasted groups being due to chance is less than 1 in 100.

TABLE I

Psychiatric assessment of groups of graduated and tour-expired aircrew

Predisposition	No. of cases		Percentage of cases	
	Graduated	Tour-expired	Graduated	Tour-expired
Nil	421	240	42	72
Slight	470	88	46	26
Moderate	97	5	10	1·5
Severe	21	2	2	0·6
Total	1,009	335	100	100

It will be seen that the proportion of men considered predisposed was significantly greater before advanced flying training then after a tour of operations. Considering those with moderate or severe predisposition the proportion was six to one and considering all with even the slighter degrees of predisposition it was two to one. Provided that the psychiatric procedure and standards of assessment of predisposition were kept uniform this means that a proportion of predisposed individuals is somehow eliminated in the course of late training and on operations. The possible ways in which this can be brought about include the wastage from technical inefficiency, accidents, physical shortcomings, neurosis, or forfeiting the confidence of the commanding officer, and the losses in operations due to enemy action.

The assessments in Table I may with advantage be considered against similar assessments in other groups of flying personnel. For this purpose severe predisposition will be considered alone, since in this and other investigations the criteria for severe predisposition were similar—they were the presence of psychiatric signs which would have led the examiner to advise rejection had they been recognised on entry.

TABLE II

Psychiatric assessment of severe predisposition in different groups

Subject	Examiner	No. of cases	Percentage severely predisposed
Tour-expired pilots	Present	335	0·6
Pilots u/t (S.F.T.S.)	Present	1,009	2
Unselected flying personnel	Williams (Chap. XIV)	100	3
Flying personnel entrants	Gillespie	600	3
,, ,, broken down late in ops.	R.A.F. psychiatrists (Chap. X)	730	11
,, ,, ,, ,, early in ops.	,,	688	18
,, ,, ,, ,, in flying training	,,	676	27
, ,, ,, ,, before flying training	,,	106	36

Before taking these highly significant figures at their face value, it should be realised that not only is it impossible for different observers to maintain exactly the same standards of assessment but it is impossible for the examiner not to be influenced by the man's performance in making the assessment. As will be shown neither of these factors are considered to have affected the figures greatly in the present enquiry.

(b) Reliability of individual assessment

TABLE III

Reliability of individual assessment in the case of graduated pilots (Harrogate)

Graduated pilots (Harrogate)	No. of cases		Percentage of cases	
	Observer 1	Observer 2	Observer 1	Observer 2
Nil	218	203	43	40
Slight	221	249	44	49
Modern	57	40	11	8
Severe	8	13	1·6	2·6
Total ..	504	505	100	100

TABLE IV

Reliability of individual assessment on the case of tour-expired pilots

Tour-expired pilots	No. of cases		Percentage of cases	
	Observer 1	Observer 2	Observer 1	Observer 1
Nil	120	120	71	72
Slight	46	43	27	26
Moderate ..	1	4	0·6	2·4
Severe	2	0	1·2	0·0
Total ..	169	166	100	100

These tables show that there is very close agreement between the distribution of the assessments made by the two observers in similar groups of subjects.

TABLE V

Comparison of individual assessment of moderately and severely predisposed pilots

Pilots	Percentage moderately and severely predisposed	
	Observer 1	Observer 2
Graduated	12·6	10·6
Tour-expired	1·8	2·4
All Pilots	10·1	8·5

There is a difference in this table of 1 : 6 ± 1·6.

(c) **Score of personality traits**

Tables VI and VII show for each grade of predisposition the proportion of men who revealed 0, 1, 2, 3, etc. of the ten traits listed on page 210. Thus of the 421 pilots under training who were assessed as nil predisposition, 70 per cent had no traits, 22 per cent had 1, 6 per cent had 2, 2 per cent had 3, the average number for the group being 0·4 per man.

TABLE VI

Percentage of graduated pilots who revealed a given number of traits

Grade of predisposition	No. of cases	Percentage with given No. of traits							Average No. of traits per case
		0	1	2	3	4	5	6	
Nil	421	70	22	6	2	—	—	—	0·4
Slight	470	20	29	31	17	2·4	—	—	1·5
Moderate ..	97	—	12	28	28	18	10	3	3·0
Severe	21	—	—	5	14	38	29	14	4·3
Total ..	1,009	39	24	20	12	3·6	1·6	0·6	1·2

TABLE VII

Percentage of tour-expired pilots who revealed a given number of traits

Grade of predisposition	No. of cases	Percentage with given No. of traits						Average No. of traits per case
		0	1	2	3	4	5	
Nil	240	30	37	22	10	0·4	—	1·1
Slight	88	—	16	39	41	5	—	2·3
Moderate	5	—	—	—	40	20	40	4·0
Severe	2	—	—	50	—	—	50	3·5
Total	335	22	31	26	18	2	1	1·5

Table VI relating to the 1,009 pilots under training shows that there is a direct relationship between the score of traits and the psychiatric assessment (*vide* the average numbers). There is, however, a considerable amount of overlap between the different degrees of predisposition. For instance, although 43 per cent of the 21 men assessed as severely predisposed had 5 or more traits, 19 per cent had 3 or less, compared with 13 per cent and 68 per cent of the moderately predisposed. Putting it another way, if a score of 5 traits or more were used as a criterion for rejection, only 9 of a possible 21 severely predisposed would be rejected and 13 of those not so predisposed would also be rejected ; in absolute numbers the potential wastage would be greater than the saving.

Although there is this direct relationship between score and assessment the differences between them warrant two conclusions :—

That a simple addition of the number of handicapping traits revealed by a man does not necessarily give the same measure as a psychiatric assessment on the basis of an interview, i.e. factors other than those in the score of traits must have been considered by the assessors.

Rejection on the basis of this total score would be unprofitable, assuming that evidence of severe predisposition warrants rejection.

Comparison on the score of traits tabulated against psychiatric assessment shows that discrepancies exist between Tables VI and VII. The most serious of these discrepancies are all in the same direction (indicated by the average number of traits) which is to relate a higher trait score to the same assessment of predisposition in the tour-expired pilots than those under training. Thus in Table VI, 70 per cent of *nil* assessments had a trait score of 0 compared with 30 per cent in Table VII, while of those with *slight predisposition* there are 20 per cent with no traits in Table VI contrasted with 0 per cent in Table VII.

The immediate explanation is that the assessors tended to ignore the measure of handicapping traits in the personalities of the successful pilots in making their assessments. In reports on the method which the investigators presented independently, and which form the basis of the Appendix to this chapter, it was stated that this was unlikely to be the main cause of the discrepancy ; on the contrary, the investigators, aware of this possibility, thought that they may have erred in the opposite direction. They thought that the tried and successful man was more likely to disclose minor personality traits, of little moment for the observer, in making an assessment, but worthy of note when recording traits.

4. Distribution of traits

(a) Relation of single traits to assessment of predisposition

TABLE VIII

Comparison of percentage distribution of traits in pilots u/t and tour-expired

Predis-position	Percentage distribution of traits (*The figures* i *to* x *refer to traits enumerated in the pro forma* (*page 206*))																			
	(i)		(ii)		(iii)		(iv)		(v)		(vi)		(vii)		(viii)		(ix)		(x)	
	u/t	op.	u/t	op.	u/t	op	u/t	op.	u/t	op.	u/t	op	u/t	op.	u/t	op.	u/t	op	u/t	op.
Nil ..	6	13	—	—	6	29	14	34	0·2	2	—	—	0·5	0·4	—	0·4	13	35	—	—
Slight ..	27	52	1·5	—	41	56	45	67	1	2	7	2	2	1	6	7	22	45	1·5	1
Moderate	50	60	4	20	67	80	58	100	29	20	30	20	6	—	21	40	21	60	8	—
Severe ..	76	100	5	50	86	50	86	—	38	—	52	—	5	50	23	50	43	—	19	—
Total	22	25	1	0·3	30	38	34	44	4	2	7	1	1·5	1	5	3	18	38	2	0·3

In Table VIII the distribution of each of the traits in the two groups of pilots is presented against assessment of predisposition, considering the traits in two ways : contrasting their distribution in the two groups, *i.e.* their relation to actual success : considering their distribution against predisposition, *i.e.* their relation to assessment of potential success. In Table IX the actual number of traits present in the severely predisposed group and in all the others is shown. Only the u/t pilots are considered since there were only 2 severely predisposed in the tour-expired group.

TABLE IX

1,009 pilots u/t	No.	Representation of each trait (*For identification of traits see page 206*)									
		(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Severely predisposed	21	17	1	18	18	8	11	1	5	9	4
All others	988	204	11	272	323	32	59	15	45	171	15

To simplify the comparison, the representation of the individual traits in the severely predisposed group and in the others is expressed in a different form in Table X. Here it is shown as a percentage of the cases in each group and as a ratio of the percentages to each other.

TABLE X

1,009 pilots u/t	No.	Percentage representation of each trait (*For identification of traits see page 206*)									
		(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Severely predisposed	21	76	4·8	85·7	85·7	38·1	52·4	4·8	23·8	42·9	19·0
All others	988	20·6	1·1	27·5	32·7	3·2	6·0	1·5	4·6	17·3	1·5
Ratio Severe/Others	0·02	3·6	4·4	3·0	2·6	11·6	8·5	3·1	5·1	2·5	12·6

This table shows which single traits relate most closely to severe predisposition and least closely to other assessments of predisposition in this group of cases. It consequently throws some light upon one aspect of the psychiatric method which was used by the two investigators. Similar tables may also be constructed for the other three grades of predisposition, by referring to Table VIII. The following points emerge from a study of Tables VIII, IX and X.

(1) No single trait indicates failure to survive on operations.

(2) Some traits—(iv) (iii) (ix) (i)—(*physiological instability, anxiety and morbid fears, obsessional and positive family history*) are heavily represented in that order in both groups of pilots and in each grade of predisposition and consequently relate least closely either to the assessment of predisposition or to the likelihood of failing to complete a tour.

(3) The other six traits are infrequently represented in both groups, so that although they may relate closely to either assessment or survival on operations, their representation in the total population may be so sparse as to reduce their value. It may be of course that success to the end of Service Flying Training School (in the u/t group) has reduced their incidence to its present level, for example, that the rarity of trait (ii) (previous nervous breakdown) is explained by the failure of men with this trait to stay such an arduous course.

(4) The loose direct relationship between traits and assessment again shows that although each trait was taken into account, the assessment was heavily influenced by other factors.

(5) The traits which seem to relate most closely to the psychiatric assessment and to survival on operations are in order (vi), (v), (x) and (viii) (*lack of aggressiveness, timidity, psychological immaturity* and *affective lability*). Although a previous nervous breakdown and lack of persistence are so rare in these groups of selected and tried men, their very rarity may have importance. Unfortunately no data are available upon this point.

(b) **Relation of pairs of traits to severe predisposition**

It is obviously of greater value to consider the relationship to assessment of groups of traits rather than single traits. The combinations of traits which relate most closely to the three grades of predisposition in the pilots u/t will be analysed. First, pairs of traits will be considered and then groups of three traits.

The occurrence of any combination of two of the ten traits in the four grades of predisposition is laid out in the following Tables (XI (*a*), (*b*), (*c*), (*d*) and (*e*)). In these tables any trait read horizontally has occurred in association with any trait read vertically the number of times given in the appropriate position. For example, from Table XI (*a*) trait (iii) (*morbid fears: anxiety*) and trait (iv) (*physiological instability*) occurred together 15 times in 21 severely predisposed subjects.

TABLE XI(a)

Combination of two traits in 21 severely predisposed subjects

In this and the following tables the figures (i) to (x) refer to traits enumerated in the pro forma on page 210

Traits	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
(i)	17	1	14	13	5	9	—	4	7	2
(ii)		1	—	1	—	—	—	1	—	—
(iii)			18	15	7	9	1	3	9	4
(iv)				18	6	9	1	4	7	3
(v)					8	5	1	1	4	4
(vi)						11	1	2	3	3
(vii)							1	—	—	1
(viii)	Total cases : 21							5	2	1
(ix)	Total with more than one trait : 21								9	1
(x)										4

TABLE XI(b)

Combination of two traits in 97 moderately predisposed subjects

Traits	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
(i)	50	2	37	29	15	14	3	10	10	7
(ii)		4	1	2	1	1	—	2	1	—
(iii)			65	39	17	20	3	13	15	7
(iv)				56	14	14	4	10	11	7
(v)					29	9	1	5	4	1
(vi)						30	3	4	4	3
(vii)	Total cases : 97						6	1	0	0
(viii)	Total with more than one trait : 97							20	5	2
(ix)									20	1
(x)										8

TABLE XI(c)

Combination of two traits in 470 slightly predisposed subjects

Traits	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
(i)	123	1	48	67	—	7	1	9	27	1
(ii)		7	3	3	—	—	—	—	1	—
(iii)			191	106	3	10	1	11	52	4
(iv)				214	3	9	3	14	39	2
(v)					4	1	1	1	1	—
(vi)						41	—	1	7	1
(vii)							8	1	—	—
(viii)	Total cases: 470							26	5	1
(ix)	Total with more than one trait : 234								101	—
(x)										7

TABLE XI(d)

Combination of two traits in 421 subjects with no predisposition

Traits	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
(i)	25	—	3	4	—	—	—	—	7	—
(ii)		—	—	—	—	—	—	—	—	—
(iii)			25	8	—	—	—	—	8	—
(iv)				61	—	—	—	—	17	—
(v)					—	—	—	—	—	—
(vi)						—	—	—	—	—
(vii)							2	—	—	—
(viii)	Total cases : 421							—	—	—
(ix)	Total with more than one trait : 31								54	—
(x)										—

TABLE XI(e)

Combination of two traits in 988 subjects with all grades of predisposition other than severe

Traits	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
(i)	208	3	88	100	15	21	4	19	44	8
(ii)		17	4	5	1	1	—	2	2	—
(iii)			281	153	20	30	4	24	67	11
(iv)				231	17	23	7	24	67	9
(v)					33	10	2	6	5	1
(vi)						61	3	6	5	1
(vii)							16	2	—	—
(viii)	Total cases : 988							46	10	3
(ix)	Total with more than one trait : 362								175	1
(x)										15

In these contingency tables, the pairs of traits which are associated most frequently with the different degrees of predisposition can be determined. From Tables XI (*a*) and (*e*) it is possible to recognise the combinations of traits which are encountered most often in the severely predisposed and least often in the others. The results of this search are shown in the following tables (XII and XIII).

TABLE XII

The percentage occurrence in each grade of predisposition of all pairs of traits encountered in at least 1 in 10 of the severely predisposed

Pairs of traits	Percentage occurrence in different grades of pre-disposition				
	Severe	Moderate	Slight	Nil	All except severe
(iii) and (iv) ..	71	40	22	1·9	15·5
(i) and (iii) ..	67	38	10	0·7	8·8
(i) and (iv) ..	62	30	14	1·0	10·0
(i) and (vi) ..	43	14	1·5	—	2·1
(iii) and (vi) ..	43	21	2	—	3·0
(iii) and (ix) ..	43	15	11	1·9	6·7
(iv) and (vi) ..	43	14	1·9	—	2·3
(i) and (ix) ..	33	10	5·7	1·6	4·4
(iii) and (v) ..	33	18	0·6	—	2·0
(iv) and (ix) ..	33	11	8·3	4·0	6·7
(i) and (v) ..	24	15	—	—	1·5
(i) and (viii) ..	19	10	1·9	—	1·9
(iv) and (viii) ..	19	10	3	—	2·4
(v) and (ix) ..	19	4	0·2	—	0·5
(iii) and (x) ..	19	7	0·8	—	1·1
(v) and (x) ..	19	1	—	—	0·1
(vi) and (ix) ..	14	4	1·5	—	0·5
(vi) and (x) ..	14	3	0·2	—	0·1
(iii) and (viii) ..	14	13	2·3	—	2·4
(iv) and (x) ..	14	7	0·4	—	1·0
(i) and (x) ..	10	7	0·2	—	0·8
(vi) and (viii) ..	10	4	0·2	—	0·6

The 12 pairs of traits which seem to have the most exclusive representation in the group of severely predisposed subjects are shown in descending order in the following table, against their percentage occurrence in the 21 severely predisposed, and against the ratio of that percentage in the severely predisposed to the percentage occurrence in all other cases. It will be seen that these combinations are, broadly, made up of the commonly occurring traits (i), (iii), (iv) and (ix) with the rarer ones (vi), (v) and (x) in that order, or of any two of the uncommon traits. It can be concluded from this that a pair of the traits (i), (iii), (iv) and ix) have little value *per se*, that one of these traits with any other trait has importance, while pairs of any of the other traits are likely to lead to the assessment of severe predisposition. The association of pairs of traits with severe predisposition alone is not, however, very close except when made up of traits (v), (vi) and (x). The occurrence of three traits should therefore be examined.

TABLE XIII

Pairs of traits	Percentage occurrence in severely predisposed	Ratio of this percentage to percentage in all other grades
(v) and (x) ..	19	190·0
(vi) and (x) ..	14	140·0
(i) and (vi) ..	43	20·5
(iv) and (vi) ..	43	19·0
(iii) and (vi) ..	43	14·3
(v) and (ix) ..	19	38·0
(vi) and (ix) ..	14	28·0
(iii) and (v) ..	33	16·5
(i) and (v) ..	24	16·0
(iii) and (x) ..	19	17·0
(iv) and (x) ..	14	14·0
(vi) and (viii) ..	10	16·5

(c) Combination of three traits

The occurrence of three traits in each grade of predisposition was determined : all groups of three traits which were met in the 21 severely predisposed subjects were included. There were 58 of them. A digest of the results which follows simply elaborates the conclusions reached for pairs of traits. Combinations of three traits from (i), (iii), (iv), and (ix) are so often met in assessments of less than severe predisposition that they have little value. Two of these traits with traits (vi), (v), (x), (viii), (vii) or (ii) in that order have an increasingly close relationship to severe predisposition while one of them, with two of the others, in that order have a much closer relationship. Three of these less frequently encountered traits occurring together make the assessment of severe predisposition practically certain. Six of these groups of three traits occurred eight times in the 21 severely predisposed, only once in the 93 moderately predisposed and never in the 895 other cases. It must be remembered that these 1,009 men have already been highly selected and have successfully reached a late stage of pilot selection so that the relative absence of such traits as (ii) (*previous nervous breakdown*) may be due to the very high selective value of such a trait. This, from general experience, is most likely to be the case, and it is certain that a psychiatrist would require strong reasons for accepting a man who had already had a neurosis. It is probably best, therefore, to neglect the fairly constant order in which the traits are encountered in this series of cases and to state that those which have the closest relationship alone or in combination to the assesments of severe predisposition and the least to other assessments are (ii), (v), (x), (vii), (viii), and (x) (*previous nervous breakdown, timidity, lack of aggressiveness, lack of persistence, affective lability* and *psychological immaturity*) while the others (i), (iii), (iv) and (ix) (*family history, morbid fears and anxiety, physiological instability* and *obsessional*) are so diffusely scattered throughout all the subjects that they have an ancillary value only in assessment.

From all this it is clear that although the direct relationship between a simple score of traits and psychiatric assessment is not a very close one, it can be rendered very close indeed by suitable selection of traits and for practical purposes the score and the assessment may be considered almost identical if a score based on certain groups of 3 or more traits is used. It may be concluded that, although other factors are used to form an assessment, certain combinations of traits are so frequently found in the severely predisposed, that they can be used as a framework upon which a total assessment may be based.

In using the traits in this way it is useful to have some idea of their selective importance, either alone or in groups. The following scheme shows their relative value on the basis of the correlations found in this investigation, but the order should not be considered to be hard and fast. As will be seen from the subsequent discussion its application depends upon the assessor as well as upon the subject being assessed. The direct relationship to severe predisposition in the list increases from above downwards.

5. Selective importance of the traits

Single traits	Little value alone.
Paired traits	Previous nervous breakdown, timidity, lack of aggression or persistence, affective lability or psychological immaturity in any pair.
Three traits	Any three of the above or positive family history, morbid fears and anxiety, physiological instability or obsessional temperament in approximately that order with any pair in 2.

Four traits	Not more than two of the traits in three with any others, of greatest value roughly in the order shown.
Five traits or more ..	Any combination following the order already outlined.

6. Reliability of individual psychiatric scores

It has been shown that a score of traits is directly related to assessment of predisposition to breakdown but that it is not closely related either to this or to survival in operations. The relationship does not appear to be close enough to enable a simple score of this sort to be used per se, although the traits in the score have been shown to be valuable in framing a psychiatric assessment. It remains to be seen how reliable are the scores of different examiners.

A comparison of the results of both observers in both groups is given in Tables XIV and XV.

TABLE XIV

Comparison of percentage distribution of traits in pilots u/t and tour expired (Observer 1)

	Percentage distribution of traits (*The figures* (i) *to* (x) *refer to traits enumerated in the pro forma, page* 206)																			
	(i)		(ii)		(iii)		(iv)		(v)		(vi)		(vii)		(viii)		(ix)		(x)	
	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.
Nil ..	3	10	—	—	2	12	5	23	0·4	—	—	—	—	—	—	1	8	29	—	—
Slight ..	17	46	0·4	—	31	37	35	70	0·4	2·0	8	2·0	—	2·0	7	4	19	52	—	1·0
Moderate	47	100	5	—	58	—	52	100	28	—	21	—	5	—	14	—	21	100	2	—
Severe	77	100	75	50·0	87	50	87	—	—	—	38	—	—	—	25	50	25	—	—	—
Total	15	20	2	0·5	23	20	25	36	4	0·5	6	0·2	1	0·2	3	2	15	36	—	0·5

TABLE XV

Comparison of percentage distribution of traits in pilots u/t and tour-expired (Observer 2)

	Percentage distribution of traits (*The figures* (i) *to* (x) *refer to traits enumerated in the pro forma page* 206)																			
	(i)		(ii)		(iii)		(iv)		(v)		(vi)		(vii)		(viii)		(ix)		(x)	
	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.	u/t	op.
Nil	9	18	—	—	10	46	25	44	—	—	—	—	—	11	—	—	18	40	—	—
Slight ..	35	59	2	—	50	78	55	64	1	—	7	—	3	—	8	10	23	38	3	—
Moderate	57	50	3	25	79	100	65	100	32	25	43	25	8	—	30	50	20	50	18	—
Severe	77	—	8	—	85	—	85	—	62	—	62	—	8	—	23	—	54	—	31	—
Total	28	28	1·6	0·6	39	55	44	51	4·7	0·6	8·5	0·6	3	0·6	7	3·5	22	39	4	—

It will be remembered that the assessments of each observer (Tables III and IV) were practically identical. The following points emerge from a study of Tables XIV and XV.

(1) The relationship between assessment and distribution of traits differs between the two observers, so that their assessments which agreed so closely, were reached by different methods.

(2) The incidence of the traits also differs, so that the observers' standards of observation, measurement, or recording differed—indicating that they applied the method of psychiatric scoring differently.

(3) The comparative distribution of traits made by the two observers in the two groups of subjects differed, indicating further lack of consistency in the score, although their assessment was similar.

(4) The total number of traits was consistently higher in one observer's results (3 : 2) but the assessment was not affected by this.

7. Discussion

The object of the investigation was to assess certain personal qualities which contribute towards failure—or putting it another way, lack of success—in operational flying. The psychiatric claim to predict failure is based upon the temperamental features observed in men who had broken down in such a way that they had been referred for a neuro-psychiatric opinion, that is to say they had developed neurotic illness of disabling degree, or persistent loss of confidence for full flying duties without medical disability. The prediction of psychological breakdown under conditions of civil life is no new problem. It is frequently encountered by psychiatrists, but as a rule only when there has already been an episode of illness, and advice is given on the mode of life needed to prevent recurrence. The Service problem begins at the same level, that of giving a prognosis for men who have already broken down, but with the important difference that the prognosis is related to a very special kind of life situation. The neuro-psychiatrist in the Royal Air Force should be, and generally is, familiar with the details of this situation, and it has been shown in Chapter X that his ability to rate the degree of flying stress to which a man has been exposed is reasonably reliable. It has also been shown that his predictions for the future of those who after breakdown returned to full flying duty are reasonably accurate (Chapter XVII).

The neuro-psychiatrist may apply the knowledge thus gained to the problem of selecting candidates for air crews in one of two ways. First, he may rely upon the method of clinical impression basing his assessment upon an intuitive balance of all the traits, good and bad, which he is able to elicit in the course of a personal interview. The number of these traits will probably be very large. Sometimes one or two of them may load the scale heavily in one or other direction. Sometimes the balance may be decided by the sum of a great many small items. He is unlikely to claim that his interview has exhausted all the available items, and will probably admit that his choice has been partly determined by the relation of his own personality to that of the examinee. This is the method employed in all clinical history-taking, and, in so far as the experienced clinician proves right in his diagnosis and prognosis much more than the less highly trained observer, the method is of undoubted value. It is, however, unsatisfactory in so far as the observer is unable to give reasons for his opinion sufficiently detailed and complete to be assimilated by others. It is the aim of every clinical teacher to achieve this ideal of self-explanation, but it may sometimes be impossible to explain precisely how a given opinion has been reached, although it can be shown by confirmatory evidence that it was more than mere guess work. It appears that in the rapid assortment of a very large number of items, allowing for cancellation of one by another, arranging those which remain in order of their importance, and repeating the performance many times before the final balance is arrived at there are many processes of which the manipulator is unaware, and it may be as Bartlett has suggested (1943) that the capacity for this kind of automatic sifting of data depends upon a species of intelligence which is an essential ingredient of success in clinical work. If this is true there is no field of clinical work in which this faculty is likely to be so important as in psychiatry where the complexity and number of the data obtained from the history, and the lack of objective evidence are so baffling. One way then of setting about the problem of temperamental assessment is to tell the clinician to apply his experience in any way he likes and to give for his judgment all the reasons that he can without expecting that these reasons will be complete, or that two psychiatrists arriving at the same assessment in the same patient will necessarily give the same reasons. This is not a plan which will appeal to the scientific worker who has no personal experience of the clinical method, for he is asked to take a good deal on trust. We can only expect him to believe in the method if it works, and even then he will naturally and rightly press for an explanation of how it works. Nevertheless this is the traditional clinical method, which has proved itself again and again in disease. Therefore, in the present experiment which started from the observation of disease and aims at the prediction of failure the method of clinical impression was given first place.

The second method is based not upon the impression but upon the reasons given for arriving at it. It was guessed that these might be recognised in sufficient quantity in each case and classified qualitatively with enough accuracy to express a temperamental rating or score. The advantages of such a method are obvious. It might provide a standardised means of instructing in the selection of air crews any psychiatrist with the necessary technical knowledge without being unduly dependent upon his clinical or Service experience.

An investigation based upon Gillespie's suggestion of a *Schedule of Points for Rating of Temperament* (1944) has already been concluded under the auspices of the Director of Medical Services (Air) of the R.C.A.F. This, as far as we are aware, is the only previous large-scale attempt at a combined assessment of temperament in flying personnel in terms of the impression gained from the interview and a score of loading traits. The method adopted was as follows. Over 3,000 candidates for flying were interviewed by a psychiatrist as well as by the medical officer who performed the routine Medical Selection Board tests. Three kinds of assessments were made :—

> (*a*) A numerical score of handicapping personality traits under 25 headings ; (*b*) an assessment in 10 grades based on a psychiatric interview ; (*c*) an assessment made by the medical officer at the Medical Selection Board in 16 grades.

These three scores were related independently to grading by the Selection Board at the end of Initial Training School and to the man's subsequent performance under training as pilot or navigator. They were compared for consistency, the 25 traits were analysed item by item, and the results of an independent psychiatric assessment made after suspension in 100 candidates was compared with the initial assessment. The more pertinent conclusions may be summarised as follows :—

(i) Although there was variability in the distribution of all three scores between the three centres of examination, there was a significant relationship between the decisions of the Selection Board at the end of Initial Training School and the psychiatric and Medical Selection Board assessments at all, and with the psychiatric trait score at two centres, showing that there are common factors influencing all personal estimates of suitability for flying duties, as judged by success or failure at the Initial Training School.

(ii) The psychiatric assessment was significantly related to success in pilot and navigator training, although there was only a 20 per cent difference between the failure rates of the best and worst. The psychiatric trait score showed no such relationship, but the Medical Selection Board assessment did so for pilots only at two of the schools.

(iii) Only three items in the 25-point scale (*stammering, vocational instability* and *motivation*) were significantly related to pilot success, and the scores of the re-examined airmen differed greatly from the initial ones.

Although the results showed that valuable information might be obtained from a psychiatric assessment, the chief obstacle to its use seemed to be the lack of uniformity of different judges in giving a numerical assessment. Consequently it was recommended that more well-defined criteria should be adopted and that the study should be followed to the operational level.

The lack of close relationship of the psychiatric assessment to the trait score shows that the psychiatrist's final assessment took into account many more factors than were revealed in the trait score, furthermore, although there was a consistent relationship between psychiatric assessment and success at all three centres, this was only so for the medical officer's assessments at two of the centres, indicating that some of the medical officers have 'highly developed intuitive faculties which enabled them to perceive certain difficult-to-define qualities that proved to be related to pilot-training success.' The failure of correlation between psychiatric trait score and success in training must be linked with a similar lack of significant relationship between 22 of the 25 traits. Although there was a significant correlation for the other three, it was not close enough to have practical value in selection by considering the traits separately or as a group. Finally there was so much divergence in the individual interpretation of the 25-point score of traits that it was robbed of any practical value per se. It is, however, important to realise that the traits described by Gillespie were assumed to relate rather to failure in operational flying than in flying training, and that both the psychiatric assessment and score might have a different degree of relationship to operational performance.

The immediate outcome of the investigation was that the point-score of psychiatric traits which was used had no practical value alone, although the psychiatrist might use these traits in arriving at an assessment. This assessment was, however, dependent upon many other traits, loading and counter-balancing, which had not been defined. If a candidate was assessed at the lowest rating by either a psychiatrist or another medical examiner, his chances of success in flying training were very slim indeed, but above this level the correlation with success was not close enough to have practical value.

Some of these observations and conclusions are especially relevant to our own. It is to be noted first that the extension of the number of traits looked for from 10 to 25 did not result in any closer agreement between trait score and assessment nor did any of the traits not included in the list of 10 prove to have any outstanding value in this respect. As in our own observations the psychiatric assessment failed to agree with the point-score showing that the observers took into account any factors not covered by the score. These may have been other loading factors, or counterbalancing factors. There is, moreover, evidence which suggests that a personal factor in the observer, independent of psychiatric training, contributes to the assessment. So far the results are parallel with our own. Our investigation has gone further in revealing that two observers working under similar conditions and with similar material and arriving at an almost identical distribution of assessments have been guided in making their assessments by certain combinations of the traits listed, and that they have been so guided without being fully aware of the process. These combinations of traits seem to have provided the observers with an indicator in selecting what is significant from a very large number of variable factors. That such indicators form the basis of the clinical method of diagnosis is evident in the definition of syndromes in terms of objective phenomena. It is further evident in the classification of symptoms, subjective phenomena which can be assayed only by the elicitation of an introspective history. The clinician by this method can frequently select from a mass of irrelevant material data which have absolute value for the predication of objective findings. The psychiatrist is largely dependent upon the interpretation of subjective evidence in attempting to predict behaviour under given conditions. In normal practice he has available a historical record of the subject's behaviour from friends or relations, the subject's introspective account, and his own observations of the subject's reactions to the interview. In all respects and especially the the last relationship of his own personality to that of the witness is important. This of course applies to the interpretation of symptoms in all branches of medicine. There must be opportunity for comparison between the sensations of the subject and those of the observer. It is, however, more important in psychiatry than in any other field because of the complexity of thought, feeling and behaviour in relation to extremely variable conditions. The psychiatrist has often to imagine how he himself would have felt or behaved under these conditions before making the necessary correction for what he believes to be his own divergence from the normal and so arriving at a dispassionate evaluation.

In the psychiatric assessment of personality, therefore, it must be conceded that the personality of the assessor is one of the variables which must always be considered. In so far as this can be balanced by methods which are more objective the general reliability of psychiatric assessment will gain. It may be claimed for the method which has been used in this investigation that it seeks to isolate among a host of variables a variety of patterns which may serve as separate but inter-dependent structures in the general framework of assessment. The qualitative value of the traits studied is, of course, of critical importance for upon this depends the value of the statistics presented. At the end of the experiment the two observers were asked to present separately their comments on the way in which they had used the headings given to them, and their appraisal of the value of individual traits. After this had been done their reports were discussed at a meeting between the two observers, the compilers of this report and Air Commodore R. D. Gillespie, and it was decided to enquire further into the relationship of certain traits to one another. Typescripts of this part of the investigation are available on application to the authors. (*See* Appendix of this Chapter.) It was found that although there was some vagueness concerning the delimitation of the traits there was complete agreement upon central meaning and value. One further comment should be recorded. Under present conditions of air crew selection the historical record of the personality from others is lacking. This is a serious defect which we believe could and should be repaired whenever possible. Records of school life, work and past health should be forthcoming, and the attendance of a responsible relative for interview should be a condition of the examination.

The results of this investigation suggest that the method of using specific traits in the assessment of temperamental suitability for air crew duties might profitably be carried further, taking into account both loading traits and counter-balancing traits, and looking for significant combinations. The number of such combinations of both negative and positive traits would be enormous and would make the use of a numerical score unwieldly, but this does not exclude the application of the principles of the method to the form of psychiatric enquiry. It is probable for the reasons already stated that the final assessment will be most valuable when influenced by the observer's general impression. Any method which tends to fix attention upon a limited number of traits detracts from that freedom of movement and range of attention which is necessary in covering so large a field. Freedom to consider the problem as a whole and to swing rapidly and automatically from one point to another is probably essential to accuracy of clinical judgment. The attempt to think in terms of headings may have an adverse effect upon this skill comparable with that observed in a manual skill when the performer concentrates upon its separate components. Therefore, the aim should be to discover a small number of highly significant combinations which will serve as a guide to the total clinical appraisal.

8. Summary

Two groups of bomber pilots: 1,009 pupils at the end of Service Flying Training School; and 335 instructors who had completed an operational tour—were examined by two psychiatrists, each of whom independently interviewed half of each group. The interviews lasted about three-quarters of an hour, and were aimed at: assessing in four grades the man's predisposition to breakdown under conditions of operational flying, using evidence which included the man's life story to the time of commencing flying; and making a score of handicapping personality traits upon a ten-point scale which had previously been defined. The assessment and the score were to be made separately.

The data obtained by the observers were collected and analysed. Comparison was made between:—

(*a*) The assessments of predisposition in the two groups of pilots.

(*b*) The score of traits in the two groups of pilots.

(*c*) The assessments of predisposition of the two observers.

(*d*) The scores of traits of the two observers.

(*e*) The relationship of assessment to score in each group of pilots and for each observer.

(*f*) The distribution of each of the 10 traits, singly and in association with others, for each grade of predisposition assessed by each observer in the two groups of pilots.

From all this information an analysis was made of the methods used by the observers, and the place of each of the traits in relation to assessment and to the total trait score was determined. The investigators independently submitted reports upon their method. An abstract of these reports forms the substance of the Appendix to this chapter.

9. Conclusions

(1) The psychiatric assessment of two large groups of pilots shows that there is a significantly greater proportion of individuals considered to be predisposed to breakdown among pilots under training than among those who have completed a tour of operations. Two per cent of the first and 0·6 per

cent of the second showed predisposition of a degree which would have led the psychiatrist to reject them for air crew training.

(2) The agreement in the distribution of the assessments made by two independent observers was very close in each group of pilots.

(3) Although the number of pilots with a score of more than three handicapping traits was slightly higher in those under training than in those who had completed a tour, there was not a significant difference between the average score of the two groups.

(4) There was a direct relationship between psychiatric assessment and score, but this relationship was not very close.

(5) The observers considered factors other than those in the score in making their psychiatric assessment and wide discrepancy existed between score and assessment in some instances.

(6) It is not practicable to use a simple form of scoring to replace a psychiatric assessment, but the results warrant further investigation of the importance of other handicapping traits, and counter-balancing and supporting traits.

(7) If the highest grade of predisposition—*severe*—were used as a basis for rejection, 21 (2 per cent) under training and 2 (0·6 per cent) tour-expired pilots would have been eliminated. If a score of five or more traits had been similarly used the figures would be 22 (2·2 per cent) and 3 (0·9 per cent). Although the number of pilots who would be rejected is so similar, more than half rejected by one method would have been accepted by the other and vice versa ; that is to say that there is only an even chance of the same case being rejected by both methods.

(8) When the score of personality traits and the distribution of these traits is compared with the assessments of predisposition, considerable disagreement is found between the two observers. This is true not only on comparing the findings of the two observers in one group but also on comparing the findings of a single observer in the two groups.

(9) Analysis of the distribution of traits showed that—

No single trait indicates failure to complete an operational tour.

The traits which seem to relate most closely to the psychiatric assessment of severe predisposition are : Previous nervous breakdown, timidity, lack of aggression or of persistence, affective lability and psychological immaturity.

Some traits, particularly psychological instability, anxiety and morbid fears, obsessional features, and an abnormal family history, are so heavily represented in both groups of pilots that they would have a very limited value per se in selection.

Certain combinations of three or more traits, which have been described, almost invariably lead to the assessment of severe predisposition.

(10) Combinations of traits enumerated in (9) have been related to assessment of predisposition to breakdown in flying and these combinations should serve to simplify the method of assessing the likelihood of such failure.

Finally, taking all the results into consideration, the broad conclusions may be drawn that *a method of elimination on the basis of assessment of ' severe predisposition ' might be practicable and profitable. The personality traits investigated can be used with others to simplify and elucidate this assessment, although it would not be practicable or desirable to replace the assessment by a trait score.* The final evaluation of the method which has been analysed awaits the results of the main experiment.

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APPENDIX TO CHAPTER XVI

NOTE ON THE OBSERVERS' ANALYSIS OF THEIR METHOD

Introduction

Each observer has presented a full and critical report of his method which is available in typescript but as much of the material has been dealt with in the body of the report only information of special interest is abstracted below.

1. Psychiatric assessment

Both observers emphasised that they made their assessment irrespective of the score of traits they obtained, a contention which is supported by their results. Nevertheless, the fact that they were instructed to use a ten-point score just have kept those ten groups of traits before them, and it must to some extend have modified their method of interview. The form of interview adopted by each was quite different. For instance, one established rapport by talking about service life and then proceeded to obtain a detailed account of performance in the Service before enquiring into the personality before service, while the other did just the opposite, obtaining a chronological life story which ended with the service experiences. Yet the distribution of psychiatric assessments by each was the same. Again, one scored many small traits which he ignored in making an assessment, while the other did not include them either in his score or his assessment. It was clear that they both arrived at the same conclusion by different methods. As so many subjects from the same selected populations were examined by each, the results they obtained are strictly comparable.

In addition to an appraisal of his life story, the subject's appearance, behaviour and reactions during the interview were all used by both observers in arriving at an assessment. Both drew attention to the relative paucity of predisposing factors in the populations examined by them and pointed out that the subjects had already been tested and tried under training or on operations. They, therefore, considered it likely that some traits which they considered to be closely related to severe predisposition, but which were infrequently encountered (*previous nervous breakdown*, *timidity*, *lack of aggression or persistence*, or *psychological immaturity*) might be met much more frequently in the examination of air crew on enlistment.

2. Psychiatric score

Some of the observers' views upon the score of traits have already been quoted. Criticisms were :—

(*a*) Counter-balancing factors such as energetic disposition, habitual cheerfulness especially when under stress, a stable well integrated personality, high motivation, proved courage, a well developed group-sense, and in the face of difficulty were taken into consideration in making the psychiatric assessment but were not included in the method of scoring.

(*b*) Even if counter-balancing factors were enumerated a score could not take account of the *matching* of counter-balancing traits. For instance, a timid man might be fortified by a limited capacity for imagination, stubbornness and an ability to persist.

'It was felt that a schedule of unfavourable traits, without taking into careful consideration the good assets present, did not give a true picture of the total personality, or serve as a safe guide in the estimation of predisposition to breakdown or failure later on. Thus in a number of cases adverse features could be found under three or four of the headings of the pro forma used in the assessment of the pilots studied, yet due consideration to the good assets that were present resulted in a final assessment of *nil* or *slight* in many cases, as whatever demerits were found, were counter-balanced or outweighed by the good assets also present.'

(*c*) Other handicapping traits are encountered.

(*d*) The score to be equable should be weighted in favour of the more incapacitating traits. For instance, *timidity* should be scored more heavily than *physiological instability*.

(*e*) Some traits overlap, others tend to be linked, and combinations of others tend to accentuate the effect of each. For example, *anxiety* might overlap with *timidity*. *Timidity* is linked with *lack of aggression*, and *anxiety* is particularly disturbing to an *obsessional personality*.

(*f*) There is difficulty in finding for each trait a definition which has universal application, as for example in distinguishing between morbid and non-morbid obsessional features, which 'might prove an asset if present in small degree in one type of individual, but a liability if in excess in another.'

(*g*) There is similar difficulty in setting a standard for the actual scoring.

'One sometimes suspected a personality defect but considered there was insufficient evidence to warrant the recording of a mark under the appropriate heading in para. (*a*) on the pro-forma on page 210 with the result that frequently under para. (*b*) may be found such remarks as *suspect for timidity*, *persistence uncertain*, *unaggressive type* or *somewhat immature*. One result of this state of affairs was that an individual pilot might be considered to be near to *moderate* and not marked off under any of the headings.'

3. Outline of the standards adopted by the two observers in scoring the traits

(*a*) **Use of individual traits**

(i) *Family history.*—Both included first degree relatives who had either had frank psychological illness of any kind, or who had a personality defect which was obvious to others. This second group included the nervous, over-anxious, unstable and eccentric. One urged consideration of counter-balancing traits in the members of the family but had not used it.

(ii) *Previous nervous breakdown.*—The minimum standard for scoring was, to have been under medical care or absent from school in childhood, or a definite psychological illness in adult life, even though it did not mean ceasing work. Care was taken to accept very cautiously *nervous breakdown* before 10 years of age and to relate it to the family situation. On the other hand, attempts were made to recognise nervous illness simulating physical disorder.

(iii) *Morbid fears and anxiety.*—Both agreed that there should be a distinction between these two traits and that morbid fears alone, unless numerous, did not warrant a score.

'An appreciable number of otherwise satisfactory pilots had always entertained a fear or dislike of water, which had usually been brought about by some childhood experience of nearly drowning ; such pilots were in consequence either non-swimmers or timid swimmers who could not dive. Many tour-expired pilots were found to have a neurotic fear of blood, showing itself to a sufficient extent in some cases as to cause them to leave a first-aid lecture which was in progress : quite a number of these pilots were able, however, to cope quite well in real situations and to deal with casualties.'

The intensity of the anxiety reaction was thought to be more important than its presence, since many 'mildly anxious tour-expired pilots had done well.' On the other hand, mild anxiety in an obsessional was thought to constitute a handicap.

TABLE XVI

Relationship of morbid fears to anxiety, to an obsessional temperament and to an abnormal obsessional personality

Subjects	Total number of patients with				Number of patients with phobias having in addition			
	Phobias	Anxiety	Obsessional		Anxiety	Obsessional		Anxiety and obsessional temperament
			Temperament	Personality		Temperament	Personality	
Tour-expired								
Observer 1 (169) ..	23	3	51	3	—	13	—	—
Observer 2 (166) ..	67	60	65	4	36	20	2	13
U/t								
Observer 1 (504) ..	66	42	42	8	9	4	1	3
Observer 2 (505) ..	122	165	120	6	67	38	2	2
Total (1,344)	278	270	278	21	112	75	5	18

From this table—

41 per cent of subjects with morbid fears showed anxiety.

41 per cent with anxiety had morbid fears.

27 per cent with morbid fears were also mild obsessionals.

27 per cent of abnormal obsessionals had morbid fears.

1·7 per cent with morbid fears were also abnormal obsessionals.

The results indicate that morbid fears more often overlap with anxiety than obsessional features and that the two traits are sufficiently independent to justify separate scoring.

(iv) *Physiological instability.*—Both observers included disturbances of sleep, sleep walking, nightmares or night terrors, stammering, nail-biting, tics, twitchings, bed-wetting, faints and headaches. One also included teeth-grinding. A history of allergy was also looked for but was rare. Again the age of onset and cessation, the severity and cause were taken into account when making the score. They both quoted examples of successful operational pilots who showed abundant evidence of such instability, but reference to Table VIII showing the widespread representation of this group of traits makes further discussion unnecessary.

(v) *Timidity.*—Both observers emphasised the importance they placed upon evidences of timidity, and the results showed that this was closely related to their assessment of severe predisposition, and that it was rarely seen in successful pilots. They both thought that timidity was often associated with lack of aggressiveness. The actual relationship is shown in Table XVII.

TABLE XVII

Comparative incidence of timidity

Subjects	Total with timidity	Total with lack of aggressiveness	No. of these cases showing both
Tour-expired ..	7	3	2
U/t	41	70	15
Total ..	48	73	17

From this table it is seen that 35 per cent of timid people lacked aggression, 23 per cent of people with lack of aggression were timid.

The two traits of *timidity* and *lack of aggressiveness* are consequently sufficiently independent to be considered separately as single traits. Timidity was only scored when it was evident in many forms of activity, and not when associated with a single specific situation as might be the case with a phobia. In order to unmask timidity an account was obtained of :—

> 'The order of preference for games, participation in the rougher sports and in fights, his response to injuries (had they made him give up ?), interest in special sports, e.g. motor cycling and speeding, accidents he had had and his response to them, response to dissuasion by parents, particularly if he had continued in spite of it. His ability to take the usual physical risks.'

(vi) *Lack of aggressiveness.*—Distinction was made between the unaggressive types of individual, particularly those with compensating qualities, and those who showed a neurotic attitude to the subject to aggression, as for instance a strong disapproval of blood sports. Many unaggressive men proved successful pilots, and simple avoidance of the rougher forms of sport was not considered sufficient to justify a score. Furthermore many had never met situations that aroused hidden aggressive tendencies before flying, but when they did so they were found to be adequate. This was well seen in the apparently unaggressive pilots who became exceedingly angry when exposed to heavy flak and who were consequently happy in releasing their bombs on the enemy. The group with neurotic lack of aggression was a small one, but there was another small group of abnormally aggressive, psychopathic individuals who were considered to be handicapped. It follows that the score was made by an appraisal of intensity of the trait, rather than its presence.

(vii) *Lack of persistence* was scored when there was an unsatisfactory civilian employment record, absence of hobbies and interests and a tendency to tire easily, or to give up without trying to overcome difficulties. Both observers commented upon the lack of evidence of this trait, which they attributed to two causes :

> That many of the men had had little chance of showing it, for they were only 14 years old when the war began, and their lives had been greatly modified by it.
>
> That the two groups studied had necessarily had to show persistence to succeed in flying training, so that many of those lacking persistence had probably been eliminated.

(viii) *Affective lability.*—This trait excluded those with simply a mild cyclothymic temperament and with transient depressive moods, unless the depression was intense enough to interfere with social relationships or work. The duration, intensity, frequency and precipitating causes were all considered in making the score. The trait was thought to be ominous when associated with obsessional tendencies.

(ix) *Obsessional.*—Both observers included not only men with obsessional personalities, but those with milder obsessional temperaments, who were 'tidy and meticulous to the point of being fussy.' Consequently the proportion of tour-expired pilots scored as obsessional was high, for 'the quality of persistence with which such individuals are usually endowed enables them to carry on for a long time in the face of stress, before breaking down.' It seemed that the milder degrees of obsessional behaviour were an asset, so long as they were not associated with anxiety. Compulsive features were rarely encountered, but were considered to be heavily loading when present. The relationship of anxiety and of phobias to normal and morbid obsessional features has been outlined earlier.

(x) *Psychological immaturity.*—This trait included men who were still bound to the family and who had not yet become separate individuals. The results suggested that these men could not survive training to the end of Service Flying Training School. The individuals seem also tended to be timid, immature, sensitive and unaggressive.

CHAPTER XVII

PROBABILITY OF RETURN TO FULL FLYING OF MEN WHO HAVE BROKEN DOWN UNDER THE STRAIN OF OPERATIONAL DUTIES

by

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Wing-Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

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Introduction

The efficacy of different forms of treatment of flying personnel who have shown psychological disorder under the strain of operational duties has recently been under discussion. The ultimate aim of any form of treatment is to return the man to his duty fully efficient and confident. The policy in the Royal Air Force has aimed at maintaining efficiency and confidence not merely for an operational tour, but for a period of instructional duties and then for a further operational tour after this. As a result of this policy provision is made in several ways for giving tired men a break without admission to hospital or removal from duty. Thus under an Air Ministry letter a squadron commander has power to terminate a man's operational tour early if he has been exposed to exceptional stress, or if his stamina appears to be subnormal, by posting him for instructional duties before being called upon for further operational duty. Parallel with this, the policy has been adopted of encouraging the unit medical officer to take the responsibility of handling cases of incipient neurosis in flying personnel, and to foster a close liaison between himself and the executive officers responsible for the welfare of flying personnel. The squadron commander and the squadron medical officer therefore deal with these cases on the station with the least possible delay and very often without reference to the neuropsychiatrist, who only handles cases which are beyond the capacity of the unit medical officer ; those unlikely to return to operational flying ; those referred because it is uncertain whether disposal should be through medical or executive channels. The proportion of cases dealt with by the unit medical officer without having been referred to a specialist seems to vary directly with his sagacity and enthusiasm.

The time factor has to be considered in assessing the results of treatment. Under present policy, if a man has to be removed from operational flying for more than a few days, the executive are not so much concerned with the time taken to get him back to operational flying as with getting him back to it in the end fit and keen for a second tour. As the need for instructors in Operational Training Units is great, a man can be fully and usefully employed during a period of non-operational flying, but if he is to be so employed it should be for a period of at least six months to allow for apprenticeship to the new task. It thus happens that the demands of the service and the needs of the medical branch in rehabilitating these men coincide closely.

Because of the policy which has been outlined, the results of treatment must be considered in relation to the squadron medical officer and the neuropsychiatrist. The following data are derived from a card return system already described on page 118, which has been extended to include some representative squadron medical officer.

1. Data obtained on cases from representative squadron medical officers

The medical officers concerned were instructed to report the details of every case handled by them in the course of their duties in which there was evidence or suspicion of psychological disorder, whether or not the case was subsequently referred to the neuro-psychiatrist.

Of 72 such cases in operational aircrew 51 (70 per cent) were thought to be suffering from a neurosis and the remainder were considered simply as lacking in confidence. This second group was then referred for executive disposal, as the problem was not considered to be medical. Of the 51 cases of neurosis, 41 (80 per cent) returned to full operational flying, 38 after a short period of treatment by the squadron medical officer, and 3 after reference to a neuro-psychiatrist. The medical officers referred 21 per cent of all their cases for a second opinion.

2. Data obtained on cases referred to the neuro-psychiatrist

Seven hundred and thirty flying personnel who had completed more than 100 operational hours and who were referred to neuro-psychiatrists for an opinion in the year February 1942–43 were considered by them to be suffering from the effects of the strain of operational flying. The neuro-psychiatrist ultimately referred the cases to the Central Medical Board for final disposal. The board considered 48 per cent fit for full flying duties including operational flying, and 12 per cent fit for flying duties other than operational. Thus a total of 60 per cent were found fit for flying duties.

The efficiency of a sample of 200 of the cases found fit for full flying duties after recovery from a neurosis followed over a period of nine months after return to duty, is described on pages 240–243. The results were favourable, since 82 per cent returned to flying and 46 per cent to operational flying, while 70 per cent of the total were still employed on flying duties at the end of the period.

The probability of return to flying duty after psychological disorder has also been examined in relation to the degree of stress to which the subjects had been subjected in their operational tour, and the extent to which they were predisposed to neurosis. An account of the conception of flying stress and predisposition and the way in which they are assessed has been given in Chapters I, IX and X. The results of such a division of the cases are seen in the following two tables.

TABLE I

Disposal of 730 flying personnel referred to neuro-psychiatrists with symptoms of a neurosis after more than 100 operational flying hours, related to flying stress

Flying stress	Total cases	Percentage returning to		
		Operational flying	Other flying duties	All forms of flying
Nil	56	48	13	61
Slight	173	44	15	58
Moderate ..	302	46	11	57
Severe	179	56	8	64
Exceptional ..	19	38	15	53
Total ..	730	45	12	60

TABLE II

Disposal of 730 flying personnel referred to neuro-psychiatrists with symptoms of a neurosis after more than 100 operational flying hours, related to predisposition

Predisposition	Total cases	Percentage returning to		
		Operational flying	Other flying duties	All forms of flying
Nil	272	71	10	81
Moderate ..	381	43	12	55
Severe	77	14	10	24
Total ..	730	48	12	60

It appears from these tables that the factor which decides whether a man can return to operational flying is not the degree of hazard he has met on his tour but the kind of stuff he is made of. Table I shows no material difference between the chances of returning to operational or non-operational flying, with different degrees of flying stress. Table II shows by contrast that whether or not a man returns to operational flying is profoundly affected by the degree of his predisposition, since the man without predisposition is five times as likely to go back to full flying as one severely predisposed.

A criticism which may be levelled at the results in Table II is that the neuro-psychiatrist who has assessed the predisposition to breakdown is influenced by this assessment in advising upon the man's return to duty, so that the proportion returned to full flying may be merely a reflection of the observed predisposition. Although this may be true for men under training, it is much less likely to be so for men who have completed 100 operational hours. The final disposal of these men is guided less by the neuro-psychiatrist's assessment of predisposition than by his appreciation of the performance they have achieved. He is also influenced by the fact that they have completed their training and have acquired operational experience of potential value. His bias therefore is towards sending the man back to full flying duty if his clinical state is satisfactory predisposition notwithstanding.

Summary

(1) The chance of men who have broken down under the stress of operational flying returning to operational duties after treatment has been discussed. The results are those of the psychiatric methods used at the present time in the framework of the general policy laid down for the maintenance of efficiency of operational flying personnel in the Royal Air Force.

(2) Eighty per cent of a small group of men treated on the station by squadron medical officers returned to full operational duties.

(3) Forty-eight per cent of a large group of men who had completed more than 100 operational hours and who were referred to a neuro-psychiatrist returned to full flying duty, and a total of 60 per cent returned to some form of flying duty. Of 272 men in this group who did not show evidences of predisposition to neurosis, 81 per cent returned to flying duties and 71 per cent to full operational flying.

(4) The most potent factor affecting return of these experienced men to operational flying appears to be their degree of predisposition to neurosis,

since 71 per cent who showed no evidence of this predisposition returned to full flying contrasted with only 14 per cent who were considered severely predisposed.

(5) Although the degree of hazard and stress encountered in the operational tour appeared to have precipitated the breakdown, it did not affect the prognosis for full flying duties.

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CHAPTER XVIII

PROGNOSIS FOR A RETURN TO FULL FLYING DUTIES AFTER PSYCHOLOGICAL DISORDER

by

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FPRC Report 535, June, 1943

Introduction

It is important to know the prognosis for a return to full flying duties of cases who have recovered from psychological disorder, and who have been assessed as fit for operational flying duties by neuro-psychiatric specialists. The proportion of all cases referred for neuro-psychiatric opinion who are eventually recommended for a return to full duty is difficult to determine, since many are given a full medical category after a period of limited flying which may extend up to a year. All cases who have been passed fit for operational duty, either at the end of a short course of treatment or a long period of alternative employment, must be included in the total of neurosis cases eventually gaining a full category. Unfortunately, no accurate figure exists for the whole war period to date. In a personal communication Williams states that of 511 consecutive cases of psychological disorder in flying personnel 338 were given a final disposal within a year of the time of first interview, while 173 still had a temporary disposal. Of those given a final disposal, 100 or 30 per cent were assessed as fit for operational flying. A minimum of 100 out of the total 511, or 20 per cent, had thus achieved a full operational category. Since the prognosis in those cases whose disposal was still undecided at the end of the year is unlikely to be better than average, the proportion of all cases eventually becoming fit for full flying duties probably lies between 20 per cent and 30 per cent. The aim of the present investigation was to determine the quantity, and if possible the quality, of service given by crews on their return to duty after recovery by cases of psychological disorder accorded a full category by neuro-psychiatric specialists. The method employed was to follow up the flying careers of a series of cases who had been seen by specialists either at N.Y.D.N. centres or medical boards during a period of ten months, and recommended for a return to full flying duties. Their subsequent performance was then compared with the normal standards of personnel wastage in training and in operations during the period under review.

1. Detail of Method

(a) Selection of material

The case records available at No. 1 Central Medical Board and at the N.Y.D.N. Centres at Littleport and Rauceby were scrutinised. All cases of individuals classified A1B (*fit for operational flying as pilot*) or A3B (*fit combatant passenger*) were reviewed and those cases of psychological disorder of the various reaction types detailed in Chapter IX were noted for follow up. Psychological disorder of the organic type following head injury, epilepsies, migraine and organic nervous lesions were not included. Cases in which symptoms of anxiety or depression or lack of confidence followed head injury, and borderline cases of physical injury or disease with a definite neurotic factor, were included. In doubtful cases, the assistance of the specialist concerned was obtained. Some of the cases marked as fit for duty are labelled *A1B but lacking in confidence.* Such cases may be divided into those referred for psychiatric opinion for the first time and given this category, when it is implied that there is no medical reason why the individual should not be fit for duty ; and those who have recovered from their psychological disorder but who still lack confidence. In the latter group, where there is some doubt implied about the fitness for duty, the decision about air crew employment is left to the executive, who base that decision on performance in the air. Only the second group have ever been accepted as medical cases and *lack of confidence* cases of this type alone have been included in the follow-up series. With these exceptions, all cases dealt with during the ten-month period were followed up, and an unbiassed sample was thus obtained of cases of psychological disorder as thus defined which were recommended for a return to full flying duties by neuro-psychiatric specialists.

(b) Method of follow-up

The present location of all the personnel concerned was obtained through the co-operation of the Directorate of Postings, Air Ministry, and Records Office, and cases were divided into :

(i) those still surviving and employed on flying duties, operational or otherwise, at home or abroad ;

(ii) those who had become casualties ;

(iii) those not employed on flying duties ;

(iv) those who had been remustered ;

(v) those whose psychological disorder had recurred with sufficient severity to warrant lowering of the medical category by another board ;

(vi) those whose career after return had been affected by intercurrent disease.

Method of collecting data on these groups :

(i) *Survivors.*—Special forms made out for each case still surviving and employed on flying duties in this country were sent, with an explanatory letter, to the Senior Medical Officer of the Group administering the units at which the cases were serving. The forms were completed by the unit medical officers from particulars available in the man's flying log-book and medical history as noted in the Form 48 and Daily Sick Book, then returned to Air Ministry by the Senior Medical Officer with any additional comment which he cared to make. It was impracticable to obtain similar returns for cases serving overseas, but it was assumed, unless there was anything on their personal records to the contrary, e.g. remustering or reboarding, that they were employed in the capacity of the post to which they had been drafted. It is reasonable to assume that some element of selection on grounds of efficiency and suitability for prolonged operational effort comes into overseas postings. The exclusion of those posted overseas might therefore give a pessimistic bias to the general prognostic picture and the outcome of those cases is included under a separate heading in the general statement given below.

(ii) *Casualties.*—It was impossible to obtain much information about those who had become casualties, but records of the totals of flying hours, operational and otherwise, done before loss, were extracted from their log-books, which were obtained from the Central Depository. In some of the operational casualties where no log-book was available, the number of operational flying hours was obtained from the squadron operational histories (Forms 540).

(iii) *Ground Duties.*—In the case of individuals employed exclusively on ground duties at the time of survey, it was difficult to decide whether such employment implied a previous failure to perform efficiently in the air. One man in the series was found to be employed for no apparent reason as an orderly room clerk, while another, a senior officer with much operational experience, was on the staff of Combined Operations. The two cases are similar only in the fact that they are both employed on ground duties. For the present purpose it is probably safer to class all those employed exclusively on ground duties together, irrespective of their ability and desire to serve in the air, but to remember the wide range of possible explanations for such employment.

(iv) *Remusterings* in the cases of N.C.Os., and transfers to the Administrative and Special Duties Branch in the case of officers, are dealt with in the medical history file held at Air Ministry of each individual, from which the details of executive disposal were extracted.

(v) *Recurrence.*—Any recurrence of psychological disorder can be graded according to the severity of the symptoms. These may be present but either not complained of or not being severe enough to warrant boarding, or so disturbing to mental equilibrium and flying efficiency that a lowering of the medical category or repatriation on medical grounds has become necessary. A note of all boards held is made on the individual's personal card in the Directorate of Postings, and each case has been cross checked by reference to the clinical notes held at No. 1 Central Medical Board. In the analysis of cases still employed on flying duties, reference is made to those with continuing or recurring symptoms which have not necessitated reboarding.

(c) Recording of data

All cases in the series were followed up for a period of nine months after gaining a full category, the collection of data being spread over a period of three months.

RECORD CARD

Service No......... Rank........ Name........ Crew duty........

Stage in training *or* type of operational flying at time of breakdown — Unit.......... — Operational *or* Training Command

Date of being given full flying category .... — Neuro-psychiatric specialist concerned ....

No. of hours flown *non-operational* and *operational* before breakdown..........

Brief clinical note on case :

Summary of flying duties done since board

Type of aircraft......	Group......	*Non-operational*		*Operational*	
		Day....	Night....	Day....	Night....

Medical officer's remarks on present psychological condition and general behaviour :

(d) Control material

Cases were grouped according to their eventual outcome to present a general picture, and then analysed from different viewpoints to elicit the prognosis of certain broad categories. The series was controlled, firstly by comparison with the level of flying performance attained before breakdown, and secondly by comparison with standards of normal expectations for the completion of training and survival on operations. These standards were based on statistical data supplied by the appropriate sections of the Training and Operational Forecasting Departments of Air Ministry. The details of the calculation of the control material are given where the comparisons with the follow-up group are tabulated.

2. Results

(a) Level of flying performance after return

From the practical point of view it is important to know what proportion of men return to the level of flying performance attained before the onset of psychological disorder and whether they have maintained that level, or regressed or progressed from it. Progress is applicable, of course, only to the training stages. The general outcome after the period of nine months may be classified by nature of air crew service, operational or non-operational, given after return. All who gave operational service after return, although now employed non-operationally or on ground duties, are included under the heading *operational* since they may have been relieved in the natural course of events. Of the 211 cases available for follow-up, full details of the type of duty performed were gathered for 204 or 97 per cent.

Table I

Type of duty being performed nine months after returning

		Number		Percentage	
(i) Operational flying	Survivors at home	38		19	
	Casualties	21		10	
	Overseas	20		10	
		—	79	—	39
(ii) Non-operational flying	Survivors at home	40		20	
	Casualties	3		1	
	Overseas	7		3	
		—	50	—	24
(iii) Ground duties	Operational flying after return	0		0	
	Non-operational flying after return	2		1	
	No flying	12		6	
	Overseas	2		1	
		—	16	—	8
(iv) Remustered	Operational flying after return	4		2	
	Non-operational flying after return	1		1	
	No flying	17		8	
		—	22	—	11
(v) Recurrences (boarded)	Operational flying after return	6		3	
	Non-operational flying after return	14		7	
	No flying	5		2	
		—	25	—	12
(vi) Under treatment for other diseases.	Operational flying after return	5		2	
	Non-operational flying after return	6		3	
	No flying	1		1	
		—	12	—	6
	Total		204		100

Summary

Total number who did operational flying after return (including casualties)	94		46
Total number who did non-operational flying after return	73	or	36
Total number who did *no* flying after return	37	or	18
Total	204		100

Recurrence rate, 12 per cent

Total employed on flying duties at end of period (including casualties and other diseases)	140	or	70 per cent

From this it will be seen that although over three-quarters of the cases went back to flying duties, one-third of the original number became non-effective as members of operational crews within the period of follow-up. This trend may also be seen in the comparison made below between the level of duty performed before breakdown and after the nine months' interval. (In this and other tables, all 12 cases with intercurrent disabilities and 1 case who had not had time to complete training have been omitted.)

TABLE II

Type of duty being performed before breakdown and after test period

Before breakdown			After test period		
Duty	No.	Percentage	Duty	No.	Percentage
Operational ..	144	75	Operational ..	80	42
Non-operational	10	5	Non-operational	47	25
Under training	37	20	Grounded ..	64	33
Total ..	191	100	Total ..	191	100

Table II has clearly shown that there has been a deterioration in the level of flying activity, for 33 per cent of the total number have been grounded for one reason or another, and this one-third decrease in effectiveness is also reflected in the decrease of the number doing operational flying.

(b) Progress in training

This deterioration may also be seen in the proportion who fail to complete their training. The normal expectation for the completion of training, i.e. of reaching the operational level, can be obtained for each crew duty from the statistical records of the Training Research section. Available figures for the period before *Grading* was introduced when the men in the series were under training give the following proportions for pilots :—

TABLE III

Percentage of subjects under training normally expected to reach operational level

Training stage	Percentage expected to reach operational level
Initial Training Wing	53·5
Elementary Flying Training School	57·8
Service Flying Training School ..	77·0
Advanced Flying Unit	90·0
Operational Training Unit ..	92·5

Thus, for example, of 7 men at the Elementary Flying Training School, 58 per cent or 4, might normally be expected to complete training. Applying these proportions to the observed pilots at each stage and similar appropriate proportions for other numbers of crews, the following results are obtained :—

TABLE IV

Comparison between expected and actual percentage of pupils reaching operational level

Stage reached	No. of cases	Percentage normally reaching Op. level	No. expected to reach Ops. at rates in Col. 3	No. actually reaching Ops.
Air Gunnery School	1	89·0	·9	1
Signals School	3	87·5	2·6	1
Elementary Flying Training School ..	7	58·0	4·0	—
Service Flying Training School	3	77·0	2·3	2
Advanced Flying Unit	3	90·0	2·7	3
Operational Training Unit	20	92·5	18·5	17
Total	37	84	31	24

From Table IV it appears that although 6 men might have been expected to fail to reach the operational level, 13 in fact failed to do so. This might be expressed by saying either that the number of failures was twice normal expectation, or that the percentage of successes in the returned cases was $\frac{24}{31}$ or 77 per cent of normal expectation.

(c) Predisposition and prognosis

Before making a decision on the basis of this general picture, it is important to assess the prognosis in different groups within the whole series. There is reason to believe that the neurotic predisposition of the individual is the main determinant in prognosis. It has been shown by Symonds and Williams (1942) that predisposition varies inversely with the amount of flying done before breakdown. The percentage of severe predisposition falls from 42 per cent in groups who break down before starting flying training, to 6 per cent in those who have completed more than 100 hours of operational flying. To determine the influence of predisposition in prognosis, a comparison was made between the eventual outcome in a group who broke down during training and a group who had completed more than half the operational tour normally expected in the tactical groups to which they belonged. These groups being at opposite ends of the spectrum of predisposition, any difference in performance can be taken as a measure of the influence of predisposition in prognosis. It is likely, however, that the under training group who have been allowed to go on with their course were probably selected on the grounds of lack of predisposition. The numbers involved, too, are very small, but the comparison made below is suggestive of a more unfavourable prognosis in the more heavily predisposed groups.

TABLE V

Comparison between the outcome in cases occurring during training and the outcome in experienced operational air crews

	Under training		More than half tour completed	
Duty	No.	Percentage	No.	Percentage
Operational	16	44	36	44
Non-operational*	8	21	20	25
Ground duties	1	3	11	14
Remustered	9	24	5	6
Recurrence	3	8	9	11
Total	37	100	81	100

Although the proportion who return to do operational flying is the same, the number who are lost to the Service either by remustering or recurrence is almost twice as many in the 'under training' group (32 per cent to 17 per cent). The proportions employed on non-flying duties are not strictly comparable in this case since many of the more veteran air crew would have been employed on staff duties in the normal course of their Service careers.

(d) **Consistency of psychiatric opinion**

Although cases may be divided into degrees of predisposition by the stage in their flying service at which breakdown takes place, such a division would be purely arbitrary and likely to lead to gross errors in prognosis in cases in the intermediate groups which break down early in their operational tour. Here, accuracy in prognosis must depend upon the estimate made by the psychiatrist of the relative influence of neurotic predisposition in the whole personality. There has been considerable discussion on the consistency and reliability of such estimates, although there is some evidence to suggest that with service psychiatrists whose methods can be to some extent standardised, a fair measure of agreement can be achieved (Williams 1943). In the present study it was not found possible to find an adequate series of individuals on whom a final assessment on disposal had been made independently by two psychiatrists. The end results in two groups, whose composition, measured on the basis of time of breakdown, was similar and who had been seen at the same medical board by one of the two specialists working there, were compared with the average outcome for the rest of the series studied. The results are summarised in the table below.

TABLE VI

Comparison between outcome in two similar groups seen by different psychiatrists

Duty at date of breakdown	A	B	Average of others
More than half tour	46	48	40
Less than half tour	31	32	34
Non-op. ..	8	3	5
Under training ..	15	17	21

Duty after test period	A	B	Average of others
Operational	51	48	37
Non-op.	25	22	25
Ground duties ..	8	13	9
Recurrence and re-mustered	16	17	29

Note.—No. seen by neuro-psychiatrist A, 39.
No. seen by neuro-psychiatrist B, 31.
No. seen by other neuro-psychiatrists, 121.
Results are expressed in percentages of these totals.

From Table VI it may be inferred that the end results in similar groups of cases seen by Service psychiatrists who have collaborated to standardise their methods of assessment, will fall into very similar groups. It would appear from these results that the eventual outcome will depend on the calibre of the human material and that the assessment of the factors of temperamental handicap and personal morale by Service psychiatrists is at least consistent. Although this prognostic opinion is consistent in its degree of accuracy, there remains over 20 per cent of those marked fit for full flying duties who become non-effective as operational air crews. It must be remembered, however, that nine cases in the series were marked down as *A1B but lacking in confidence,* it being implied, as already explained, that although they had recovered from their psychological disorder, the decision on their fitness in the wider sense for flying duties must lie with the executive. Of the nine, seven were removed from flying duties by the executive. Two men did in fact continue on flying duties and in these and other doubtful cases, e.g. where some predisposition is evident, psychiatrists no doubt feel impelled to give these individuals the opportunity of regaining their previous level of flying duty.

(e) Quantity of service given

The quantity of flying service given can be simply expressed by noting the average number of flying hours done by the operational and non-operational groups for whom full details are available.

The *operational group* did on an average 25·5 operational hours.

The *non-operational group* did on the average :
231 non-operational hours (day).
42 non-operational hours (night).

Total .. 273 non-operational hours in the 9 months' period.

These figures, although giving a broad indication of the quantity of service given, are difficult to assess in the absence of a suitable control group. In the non-operational group at least, an adequate return in service as air crews has been given.

(f) Quality of service given

From the operational point of view, it is important to assess by comparison with suitable standards of performance in action, the efficiency of those who have returned to operational flying. Such a yardstick is difficult to construct, particularly for so varied an assortment of tactical functions as are included in the present series. A rough assay has been attempted by calculating the casualty rate, the frequency of neurotic symptoms and by investigating pilot error accidents. In view of the inadequacy of the control material and the smallness of the numbers, no statistically definite result can be obtained, but the material available is given and possible inferences discussed.

(i) *Casualty rate.*—It is reasonable to assume that the risk of becoming a casualty is increased by inefficiency. One measure of the efficiency with which the returned cases carried out their operational duties may therefore lie in a comparison of the actual casualty rate they suffered during the operational work they performed after return, and the average casualty rate of the squadrons to which they were posted. Taking 38 cases who went back to night bomber units (the only homogeneous group of any size available), it is found that they actually suffered 17 casualties while at the average rates of their squadrons during the same period 15 would have been expected. Clearly such a small excess might be due to chance and the most that can be said is that the return cases in this type of duty suffered no grossly disproportionate casualty rate.

(ii) *Frequency of symptoms.*—The association of neurotic symptoms and lowered operational efficiency has already been pointed out (Reid, 1942). The proportion of the group who have symptoms might therefore be taken as a measure of the residual effects of psychological disorder on health and efficiency. As before, the severity of these symptoms may be assessed by noting whether or not a lowering of the medical category was required. In a group of 96 who survived after returning to flying duties in this country and for whom full medical reports are available, the classification of the frequency of neurotic symptoms for those employed on operational and other flying duties, may be tabulated thus :—

TABLE VII

Frequency of neurotic symptoms among returned cases while employed on flying duties

	Total	No symptoms		Symptoms		Boarded	
		No.	Per cent	No.	Per cent	No.	Per cent
Non-operational ..	52	26	50	12	23	14	27
Operational	44	29	66	9	20	6	14
Total ..	96	55	57	21	22	20	21

This table would suggest that of those who do in fact return to flying duties, 57 per cent will continue free of symptoms, 22 per cent will have some symptoms but will continue with flying duties, while 21 per cent will break down again. In operational flying alone, the outlook seems better but the lack of information on those who become casualties renders comparison invalid. The breakdown rate of 14 per cent may be compared with the usual expectation of breakdown in a period of nine months of operational flying which is probably about 5 per cent. There is unfortunately no reliable standard of comparison for the frequency of minor neurotic symptoms in the *normal* operational crew population. If the proportions of those with symptoms and those who break down are roughly equal, as in the returned case group, then the ratio of symptom-free and presumably efficient proportions in *returned case* and *normal* population is $\frac{66}{90}$, or 73 per cent.

(iii) *Accident histories.*—This association between symptoms and efficiency has been traced in a series of accidents which have been investigated in connection with the pilots among the returned cases. The accident records of 72 pilots of the series for the period following their return from the medical board were scrutinised. The 72 pilots had 26 crashes during the nine-month period, of which 8 were definitely pilot error in origin. Unfortunately, these numbers are too small and the types too diverse for statistical analysis, particularly in the absence of control material. Some of the histories are suggestive from the viewpoint of the association already mentioned between symptoms and flying and operational efficiency.

Case 1 : Squadron Leader B. had been awarded the D.F.C. during his first operational tour. Later he developed an anxiety state from which he recovered and then went back on operational flying in Bomber Command. He appears on the accident record because of a taxying accident, and on checking his operational performance from his squadron's Operations Record it was seen that he had abandoned five sorties for various reasons before breaking down again with complaints of visual fatigue.

Case 2 : P/O M. appears on the accident record because he had landed his Wellington with the undercarriage retracted. He was an experienced pilot who had been referred for an opinion after two crashes towards the end of his tour. He had been employed on instructional duties since seeing the psychiatrist. His medical officer says that he is now being investigated by an ophthalmologist for his complaints of headache and eyestrain.

In the case of casualties, where no full medical details are available, inefficiency which might have been due to a recurrence of psychological disorder can only be inferred. Case 3 is typical.

Case 3 : P/O H. had been seen when on fighter operations, and it had been decided, with some misgivings because of his severe degree of predisposition, to allow him to become operational again. He went to a meteorological reconnaissance squadron, where he seemed to do quite well for a time, until he was despatched on a practice flight across to Ireland. He was next heard of as a prisoner of war in Germany, and it was presumed that he had flown a reciprocal course by failing to adjust his compass.

Despite such examples, it would be unwise to assume that the absence of symptoms necessarily implied efficiency and vice versa. Case 4 illustrates the difficulties of assessment of efficiency by such a criterion.

Case 4 : P/O B. had been seen while a pupil at O.T.U. He was thought to be mildly predisposed, with excessive visceral responses, but his personal morale was good and he was given a full medical category. Nine months later he had done 99 hours operational flying, was a flight commander and his medical officer reported him "as one of the best pilots—very keen, courageous and twice has exhibited extraordinary quick thinking in doing the proper things". On going into his accident record, it appeared that he had had four crashes in succession, only one of which, however, could be definitely labelled *pilot error*.

An example of ultimate success in a case with doubtful prognosis is Case 5.

Case 5 : Sgt. K. was a borderline case—an anxious type of individual with obsessional trends who had been suspected by the psychiatrist concerned of some exaggeration of his symptoms. He was handled firmly and returned to complete 47 sorties, 25 of them with the Path Finder Force. He was decorated and commissioned and had no recurrence of symptoms of psychological disorder.

3. Conclusions

(1) 82 per cent of the cases went back to some form of flying duties after recovering from psychological illness. Only 70 per cent of the original series, however, are still employed on these duties at the end of nine months.

(2) The training wastage in returned cases is twice normal expectation.

(3) The neurotic predisposition of the individual is an important determinant in prognosis.

(4) The prognostic opinions of service psychiatrists are consistent in the degree of accuracy.

(5) An adequate quantitative return, at least in non-operational flying, is given by returned cases.

(6) The quality of service is difficult to estimate but the casualty rate among returned cases is not grossly disproportionate. On the other hand, the breakdown rate is three times normal expectation, although the efficiency of 66 per cent of those surviving on operational duties is not effected by neurotic symptoms.

(7) Specific examples are quoted of cases where it might be inferred from a liability to accidents that reduced efficiency has been either a residual effect of psychological disorder or an expression of permanent temperamental unsuitability.

These results might be summed up by saying that a process of progressive selection goes on. This progressive selection may be linked with the observations on predisposition as a determinant in prognosis. If the factors of personal and group morale remain constant, the prognosis in the individual case must depend on the loading of neurotic predisposition. In practice this means that while it is doubtful whether it is justifiable to return the more heavily predisposed, e.g. those who break down early in training, it probably is worth while to persevere with cases where the psychological disorder is the result of severe stress in an individual of stable personality. In the intermediate cases, where a rule of thumb method is even less applicable, service psychiatrists can be expected to be consistent in the standards set to determine fitness to return to full flying duty. At the present moment the setting of this standard of nervous stability required is too low to prevent a proportion of psychiatric and operational failures among the returned cases. On the other hand, too precise and rigid a criterion might result in the loss to the service of potentially valuable flying personnel. In border-line cases, where some nervous predisposition is balanced by positive temperamental assets such as persistence and determination, the psychiatrist may decide to recommend a full operational category. In that event, full weight must be given to failing efficiency and minor symptoms during the after-care of these cases, if the anticipation and prevention of a recurrence of psychological disorder is to be attained.

This survey was carried out on the instructions of the Director-General of Medical Services of the Royal Air Force, under the direction of Air Vice-Marshal Sir Charles P. Symonds and Professor A. Bradford Hill.

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CHAPTER XIX

SOME MEASURES OF THE EFFECT OF OPERATIONAL STRESS ON BOMBER CREWS

by

Squadron Leader D. D. Reid, M.D.

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Introduction

Much stress has been laid throughout the war on the determination of the optimum length of the tour of duty for flying personnel of the operational commands. The limit set must ensure that the average individual gives as adequate a contribution to the total effort of the force, as is compatible with the maintenance of his operational efficiency and his physical and mental well-being. One must also take into account the fact that he may be required subsequently to complete a period of instructing at an Operational Training Unit and return for a second tour of operational duty. The present study was undertaken in the hope that precise indications of fatigue and strain might be found for the group concerned. Three features were taken as possible indicators of changes occurring in the flying personnel employed operationally in Bomber Command due to the stresses imposed by a tour of duty limited to thirty sorties. These features were :—

(*a*) Changes in weight during a tour.

(*b*) Relative liability to psychological disorder at various stages of the tour.

(*c*) Sickness rate at various stages of the tour.

1. Method

Variations in weight.—In assessing, through numerous observers, the physical condition of a large group, as opposed to that of an individual, only the simplest and most objective measurements such as height and weight are feasible. Even with these simple measurements there are serious administrative difficulties in taking them from the same individuals at repeated intervals during their tour. This procedure was, in fact, not found practicable on any worth-while scale. An alternative approach was suggested by Wing Commander Denis J. Williams, namely, that all operational flying personnel in the command should be weighed at one point in time and a record of the number of sorties they had completed be taken at the same time. These figures would show whether there were differences in the average weight between those who had completed 0, 1, 2, 3 and so on up to 30 sorties in the main force, and more for those in the Path Finder Force. This method is admittedly open to one objection : although the sample of men who have completed these different numbers of sorties gives a cross-section of the flying population operating at the time of the experiment, those who have completed a large number of sorties are a selected group who have survived the operational hazards of the first part of the tour. It might well be that there is a selective loss in action of those whose failure in adaptation to air warfare was shown not only in their deteriorating efficiency, but also in a loss of weight. Owing to the numbers involved in each aircraft missing in action, this factor is probably of little importance. The method was therefore applied, by permission of the Air Officer Commanding-in-Chief, Bomber Command, with the co-operation of his Principal Medical Officer and medical officers. During a period of 14 days in April, 1944, all available aircrew personnel were weighed wearing Aircrew Service Dress (with empty pockets) underclothes, shirt and socks. Their standing height in socks was taken at the same time. These measurements, together with the number of operational sorties they had carried out, divided if necessary into first and second tour, were recorded on a self-coding form by the unit medical officer together with personal data required for other investigations. Weight was noted in pounds, to the nearest pound, height in inches, to the nearest inch. When these forms were returned to Air Ministry the data were transferred to punch cards which were mechanically sorted, and the results tabulated in the statistical section of the Directorate-General of Medical Services. During the same 14 days all available aircrew under training in the Operational Training Units of Bomber Command were similarly measured ; the number of hours flying done since the start of their operational training unit course was also recorded on the self-coding forms. Thus was provided a control group who were subject to the effect of a period of flying without the stress associated with the operational hazard. Height and age were included in the records as additional control material in case some selective elimination in action, due to either of these causes, was operating which might have had a secondary effect on the average weight. Such an eventuality, although possibly remote, must be taken into account before attributing any changes in average weight to the result of operational stress. It should be noted, too, that every man on the strength of the operational squadrons at the time could not be examined owing to absences on leave or on courses or on account of illness. The data for those who were on their second tour have not been used in this study as the investigation was primarily concerned with the limits of duty for the first tour. Despite these omissions the number examined was so large as to be acceptable as a very adequate sample of the total population exposed to operational and non-operational stress in Bomber Command.

Variations in the relative liability to psychological disorder.—It would be reasonable to expect that the effects of stress on a group would be revealed in a differing incidence of psychological disorder at different stages of the tour. So far, it has not been possible to measure the incidence at various points. For the present purpose, however, the real incidence at any and all stages is not essential ; what is required are figures which will reveal the *relative* incidence between one part of the tour and another. In this study a measure of this relative liability, as distinct from the absolute incidence, has been calculated. For convenience and brevity, and to stress the point that it is merely an indicator of the *relative* risk of breakdown at different stages of the tour, this measure is called an 'index' of psychological disorder. Its calculation is made clear in the working details given below and in Tables V and VI.

Since the number of sorties completed by each man involved in the weight investigation was known, the total crew population could be portioned into groups of men of similar operational experience, e.g. 1-4, 5-8 sorties, etc. It was assumed that the population exposed to the risk of psychological disorder at any time during a period of three months on either side of the date of the investigation, would be similarly divided into groups of like operational experience. In other words, it was assumed that the proportions of total crew population in these various experience groups would be stable over such a period. Next, the number of cases of psychological disorder occurring in Bomber Command squadrons, and referred for neuro-psychiatric treatment during the same period, were divided into the same groups according to their experience before breakdown. Then, a comparison of the ratios in each of these experience groups given by the number of cases as numerator, and the number exposed to risk as given by the size of the sample in the same experience group as denominator, should reveal the relative liability to breakdown within these various groups of operational experience.

A similar calculation was made from data given by an earlier study on the crews engaged in a very big operation done by Bomber Command, in 1943, when the operational experience of every man who flew on the operation was ascertained. Again, the numbers of cases of psychological disorder occurring in each experience group during a period of three months on either side of the date of the operation, were divided by the number in the sample in the corresponding experience group. Since, as stated, these ratios do not measure the absolute incidence of breakdown, comparison is only possible between the two years, if the ratios in each experience group are expressed as a proportion of the mean ratio (total cases to total population) for the relevant six-month period. It is this proportion which is referred to in this study as the *index* of psychological disorder. (The records of the cases of psychological disorder were provided on both occasions by the staff of the Air Crew Research Detachment of the Central Medical Establishment of the R.A.F.)

Sickness incidence.—The third method used for assaying the effects of stress during the tour was the Sickness Index. As part of the study of the flying personnel involved in the large operation of April, 1943, records were obtained of the number of attendances on sick parade for all complaints, psychological or otherwise, made by each man during the month previous to the operation in question. It was thus possible to compute a Sickness Index showing the relative liability to sickness, as measured by attendance on sick parade, for each stage of the tour. If the stress of operational flying produced any increase in the amount of total sickness, this rise might be adjudged, in the light of industrial experience, to be of some import. The amount of data obtained under this heading is limited as it was unfortunately impracticable to obtain similar records at the time of the physical survey of this year. This index of sickness liability can be put in the same form as the index of relative liability to psychological disorder by expressing the values at different points of the tour as proportions of the mean incidence of sickness over all stages combined. In this form it can be compared with the index of psychological disorder for both the same period in 1943 and the period in 1944.

2. Summary of results

(a) Physical measurements

The mean weights for men in each air crew duty, grouped by the number of sorties performed to give adequate numbers at different points of the tour are tabulated in full in Table A of the Appendix. Operational wastage entails an increased compass of experience to give adequate numbers in the more experienced groups. The numbers of men in each crew duty at each stage of operational experience are very similar since losses mainly occur as complete crews. The only exception to this generalisation is a rather small proportion of pilots in the group who had not yet started their tour. This was presumably due to the practice of potential captains doing a sortie as second pilot before taking their crew on their first sortie. The comparison made in this study, however, has been made between the weighted means of men at each stage of the tour totalled over all air crew duties, for three reasons.

(i) Within each air crew duty, the mean weight shows a consistent tendency to fall below its initial level.

(ii) Weighted and unweighted means for all air crew duties together show substantially the same trend.

(iii) The relatively smaller proportion of pilots in the initial group gives a conservative estimate of the mean weight before the tour is commenced, since pilots are the tallest and heaviest members of crews. (Table IX)

The broad picture of the changes in average weight during the tour is then given in Table I and in Fig. 1.

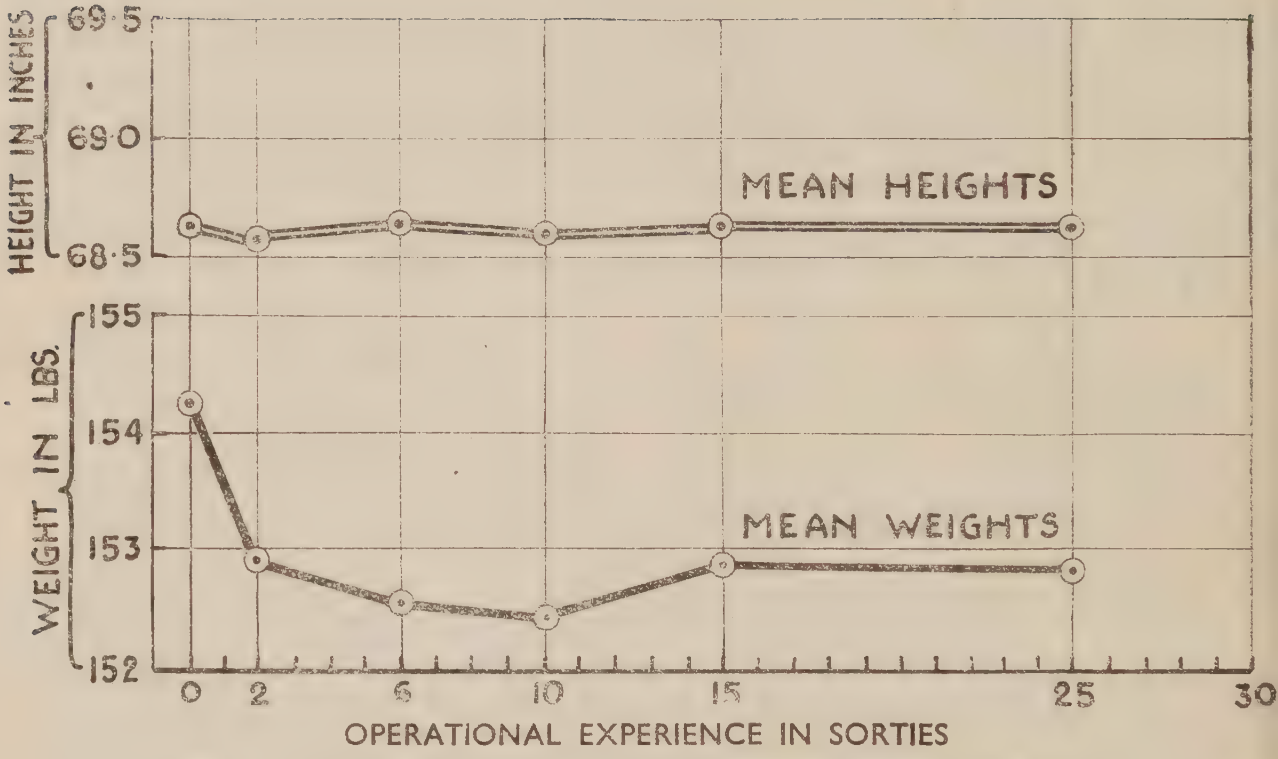
TABLE I

Mean weight at successive stages in tour

Sorties :	0	1–4	5–8	9–12	13–18	19–30	31+
No. of men	1,032	1,613	1,370	1,164	1,377	1,577	143
Mean weight (pounds)	154·22 ±·48	152·90 ±·39	152·54 ±·43	152·45 ±·43	152·87 ±·42	152·84 ±·40	152·60 ±1·39

From this table and Fig. 1 it is clear that for all air crews combined there is, during an operational tour, an average loss of rather less than two pounds in weight during the first twelve sorties. It is possible that there is subsequently

FIG. I



Mean heights and weights at successive stages of operational tour a slight gain but the figures are insufficient to prove it. At each point the average is significantly below the initial level. (The over 31 sortie group can be disregarded because of the small number upon which the mean is based.)

Before assuming that this fall in average weight is due to the stresses imposed by operational flying, adequate controls are required. The possibility of selective elimination on the grounds of age or of height has already been mentioned. To control these factors, the mean height for each aircrew duty divided into the same classes of operational experience as before were computed and are given in a similar fashion to the mean weight in Table X.

TABLE II

Mean height at successive stages in tour

Sorties ..	0	1–4	5–8	9–12	13–18	19–30
No. of men ..	1,022	1,610	1,359	1,152	1,366	1,561
Mean height ..	68·77 ±·07	68·69 ±0·6	68·78 ±·07	68·70 ±·07	68·77 ±·07	68·75 ±·06

This table and the Fig. 1 show that there are no significant changes in the mean height in serial stages of the tour, which would be sufficient to account for the fall in the mean weight. (This was confirmed by correcting the mean weight at each stage to correspond to a standard height using a regression coefficient calculated from the data. This made no material difference to the trend of mean weights throughout the tour.)

TABLE III

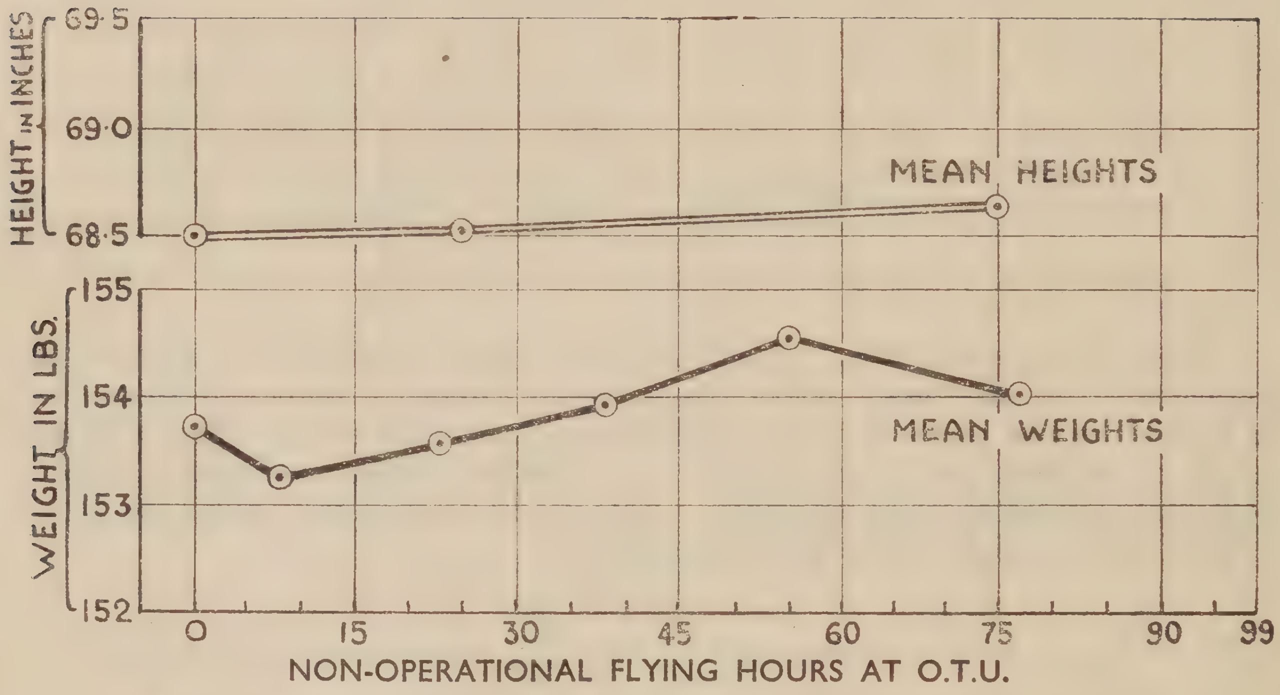
Mean age at successive stages in tour

Sorties	0	1–4	5–8	9–12	13–18	19–30
No. of men ..	1,031	1,609	1,371	1,163	1,378	1,577
Mean age ..	24·05 ±·13	24·15 ±·10	23·91 ±·11	23·96 ±·12	23·89 ±·10	24·11 ±·10

Here, too, there is no evidence that age plays a significant part in the changes in mean weights.

There remains the possibility that the changes observed are the result of stress not specifically associated with operational strain but may be observed

FIG. 2



Mean heights and weights at successive stages of pre-operational training during a period of adaptation to the more ordinary experience of a period of flying not associated with the hazards of action. This latter possibility, however, is not evident in the table of mean weight of aircrew during the various stages of their operational training. Tables IV and V show that there is no evidence of selective elimination on the grounds of height during operational training; and that there are no significant fluctuations in mean weight between serial stages of the Operational Training Unit course. The Operational Training Unit observations for weight were classified into groups of flying hours roughly comparable with the groups of operational flying experience. These conclusions are illustrated graphically in Fig. 2. (It may be noted that the average weight of those nearing the end of their training is almost the same as that of the men in the squadrons who have not embarked on their tour.)

TABLE IV

Mean height at successive stages in pre-operational training

	0	1–49	50–99
No. of men	2,783	3,766	1,847
Mean height	68·50	68·52	68·64

TABLE V

Mean weight at successive stages in pre-operational training

	0	1–15	16–30	31–45	46–65	66–99
No. of men ..	2,775	1,354	1,087	1,194	1.055	1,067
Mean weight ..	153·71	153·26	153·59	153·92	154·52	154·01

(*b*) Index of the relative liability to psychological disorder

The steps of the method described above are given in detail in Tables VI and VII where the index of relative liability to breakdown during the various stages of the tour for the two periods of six months in 1943 and 1944 is set out. Owing to the small numbers in each case who had completed more than 30 sorties only the experience classes up to 30 sorties are analysed.

TABLE VI

Psychological disorder index at successive stages in tour (1944)

Sorties	1–4	5–8	9–12	13–18	19–30	Total
(1) No. of cases of P.D. ..	60	55	39	24	26	204
(2) Sample population ..	1,613	1,370	1,164	1,377	1,577	7,101
(3) Ratio (1)/(2)	·0372	·0401	·0335	·0174	·0165	·0287(A)
(4) P.D. index (3)/A ..	1·296	1·397	1·167	·606	·575	1·00

This result may be compared with the result of the 1943 study in Table VII. If it be assumed that conditions in the two periods were roughly comparable then the similar results in the two instances would suggest that the psychological disorder index is measuring fairly consistently the relative effects on mental health of operational stress at various stages of the tour.

TABLE VII

Psychological disorder index at successive stages in tour (1943)

Sorties	1–4	5–8	9–12	13–18	19–30	Total
(1) No. of cases of P.D. ..	69	73	30	24	29	225
(2) Sample population ..	836	847	502	606	591	3,382
(3) Ratio (1)/(2)	·0825	·0862	·0598	·0396	·0491	·0665 (A)
(4) P.D. index (3)/A ..	1·241	1·296	·899	·595	·738	1·00

(c) Sickness index

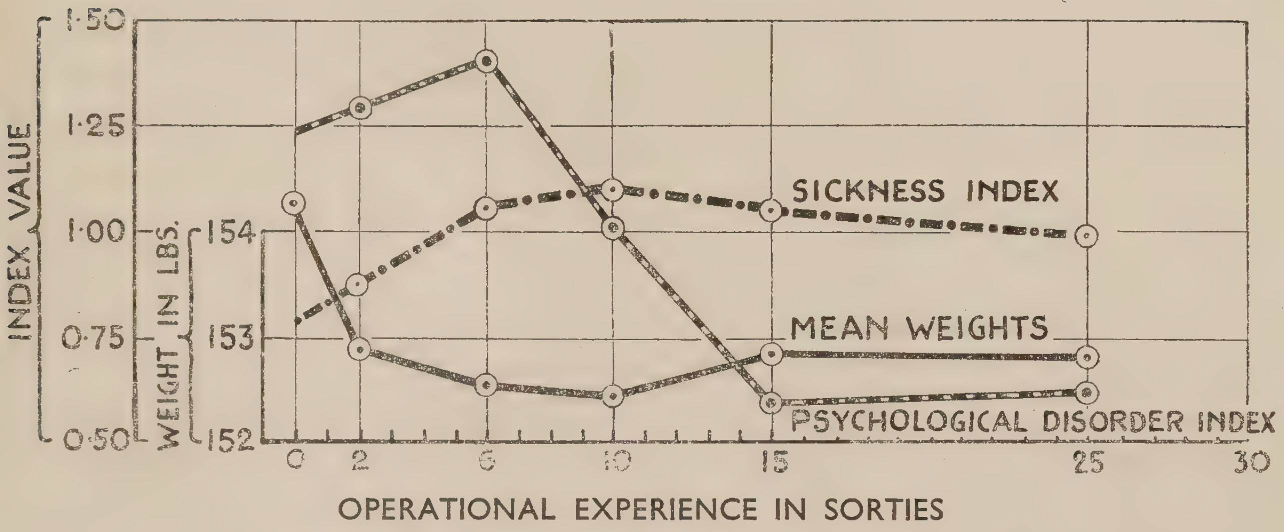
The relative liability to sickness during different stages in the tour for the 1943 period is derived as shown in Table VIII. There is a suggestion of a rise in the proportion of the strength attending sick parade during the first part of the tour but the differences are not more than might easily be due to chance. There is certainly no indication of any rise in the sickness rate in the latter part of the tour.

TABLE VIII

Sickness index at successive stages in tour

Sorties	1–4	5–8	9–12	13–18	19–30	Total
(1) No. sick in previous month	143	175	108	124	114	664
(2) Sample population ..	836	847	502	606	591	3,382
(3) Ratio (1)/(2)	·171	·207	·215	·205	·193	·196 A)
(4) Sickness index (3)/A ..	·872	1·056	1·097	1·046	·985	1·00

FIG. 3



NOTE: *THESE CURVES HAVE BEEN DRAWN BETWEEN POINTS BASED ON THE VALUES FOR GROUPS OF MEN OF SIMILAR OPERATIONAL EXPERIENCE, PLOTTED AT THE MID-POINTS OF THE GROUPS. eg—at 2 EOR THE 1–4 SORTIE GROUP—*

Values of psychological disorder and sickness indices compared with mean weight at successive stages in tour.

In Fig. 3 this sickness index is compared with the index of psychological disorder derived from summing the experience of two years (since they have been shown to be very similar). The sickness and psychological indices have both been calculated as deviations from their own means and are thus on the same scale. Fluctuations in weight are too slight compared with the size of the mean weight for a similar index to be clearly graphed ; the variations in weight have therefore been superimposed on Fig. 3 against a separate scale, *in pounds.* The three possible indicators of the effects of operational stress studied are thus brought together so that the consistency of the evidence which they provide can be examined and their applicability assessed. It is apparent that the variations in the three indicators can be interpreted as expressing in different fashions simultaneous effects of stress on the personnel of the whole group. In the early stages of the tour, between the first and eighth sorties there is a significant drop in the average weight, a suggestive, though not technically significant, rise in the proportion of men reporting sick, and a relatively high index of psychological disorder. At the 9–12 sortie group signs of improving adaptation to the new environment appear in those who survive. Mean weight shows no further appreciable decrease, the sickness rate reveals only a slight and not significant rise, and the psychological disorder index falls below the average level for the tour as a whole. At the 13–18 sortie group and beyond the three indicators remain fairly stable, suggesting that the adjustment to the environment of operational flying and its associated hazards has been stabilised, again in those who survive, at a new level.

These findings suggesting that the effects of stress are greatest at the beginning of the tour, accord well with the varying criteria of operational performance such as losses in action and accidents found in Bomber as well as other operational Commands. They do not exclude, however, the possibility that in individuals with sub-normal powers of endurance, the effects on efficiency of accumulative fatigue may reduce the chance of survival. Further, the figures given in this study give no indication of the *upper* limit of the length of tour in night bombers, they merely indicate that, as far as can be ascertained on the basis of the medical data presented, there is no evidence that a tour of thirty sorties under present conditions is incompatible with the maintenance after a period of adjustment of a steady level of mental and physical health.

3. Discussion

This study was concerned not only with the immediate problem of the operational limit for bomber operations but also more generally with the devising of techniques of objective assessment of the effects of operational stress on groups of flying personnel which might have more extensive application in similar enquiries. The three methods tested may be discussed separately from this point of view.

(*a*) *Variations in mean weight during operational and non-operational flying.*—The results obtained in this part of the investigation are probably most important in relation to the possibility that undue loss of weight might be of value in the early diagnosis of neurosis. There is no doubt that for most men, an operational tour in heavy bombers involves emotional tension and fatigue, and one of the problems of the medical officer is to decide whether a man suffering from such symptoms should be encouraged to carry on with his duties or should be rested. A reliable objective measure of the effects of stress on the individual would be of considerable value in aiding clinical impression. Knowing from Table IX that the loss in weight to be expected during the first part of the tour in the average man weighing 154 lb. is about 2 lb., any gross deviation from this expectation can be taken as a departure from normal health and when other causes of weight loss have been excluded and anxiety symptoms are present, the combination may prove significant as a measure of illness. If the routine of weighing all members of air crew on posting to a squadron were strictly enforced, and if all men, whether presenting with anxiety symptoms or not, were weighed at a later stage, it would be possible to see what individual loss in weight may be and how many men with excessive loss have an anxiety state.

(*b*) *Sickness incidence.*—As has already been pointed out, the differences in the percentages going sick in each succeeding operational experience class are not significant although the general trend is consistent with the indications of weight loss and psychological disorder incidence. From this it may be inferred, though the evidence is admittedly limited, that the index provided by the amount of sickness is less sensitive and thus less useful than either of the other two, particularly as the collection of data is no less difficult than in the weight project.

(*c*) *Psychological disorder index.*—The third possible measure of the effects of stress provided by medical data is the index of the relative liability to breakdown at various parts of the tour. It has been shown that the indications given by this index are valid in that they are consistent with the other medical criteria, and reliable in that they are comparable when repeated twice within the same command under similar circumstances, while the size of the variation suggests sensitivity. Its use in practice depends on the availability of a record system of cases of psychological disorder for all commands and a means of sampling the proportions of the total air crew population at risk in the various classes of operational experience. The record system is already in operation at the Air Crew Research Detachment of Central Medical Establishment, while the practice of recording the number of sorties already performed by the captain on the punch card version of the Raid Report may be extended beyond Bomber Command. Since the experience of captain and crew are inevitably very highly correlated, the distribution of the captains in the various experienced classes will give an accurate measure of the total numbers exposed to the risk of breakdown at any time, e.g. on a series of large raids. Given the ready availability of such information the use of this index in the detection of the effects of undue operational strain will acquire the additional asset of convenience.

4. Conclusions

(*a*) There is a significant loss in average weight during the first third of an operational tour in Bomber Command. There is no further significant decrease but to the end of the tour, the average remains below the initial level.

(*b*) This loss cannot be explained by selective elimination in action on grounds of height or age.

(*c*) The suggestion that this weight loss is specifically due to the anxiety associated with operational stress is supported by the steady mean weight of air crew during the pre-operational flying training.

(*d*) There is a suggestive but not significant rise in the proportion in successive classes of operational experience of men reporting sick, coincident with the drop in mean weight in the first part of the tour.

(*e*) There is also a significant increase in the relative liability to psychological disorder during the same period of adaptation to stress.

(*f*) The three measures are consistent in their indications of fluctuations of health during the first part of the tour. Their stability in the latter part of the tour suggests that the present tour limit of thirty sorties in bomber operations ensures removal from operational duties while the average man is still maintaining a steady level of physical and mental health as measured by these criteria, although individual cases will still require special consideration.

(*g*) The average weight finding is important in providing a baseline against which larger deviations may be measured. Such deviations may prove of value in the early diagnosis of anxiety states.

5. Summary

(1) Three possible techniques using medical data for the assessment of the optimum limit for an operational tour have been studied.

- (i) Comparison between the average weight in groups of flying personnel in different classes of operational experience from 0 to 30 sorties.
- (ii) Comparison between the proportion of men in those classes of varying operational experience attending sick parade during a period of one month.
- (iii) Comparison of the relative liability to psychological disorder at the various stages of the tour.

(2) The results of these comparisons suggest—

- (i) That there is a definite loss in weight, which is probably a specific physical effect of operational strain, during the first part of the tour.
- (ii) That there is a slight but not significant increase in the proportion of men reporting sick in the classes of men still in the first third of their tour, i.e. coincident with the loss in weight.
- (iii) There is a considerable increase in the relative liability to psychological disorder during the first part of the tour.
- (iv) After this initial period of adaptation, the levels of these there indicators remain fairly stable throughout the remainder of the tour.

(3) From these observations it is deduced that—

- (i) The first tour in Bomber Command under the conditions existing at the time of this investigation is on the whole no longer than can be performed without any proof of continuing deterioration in health by the measures used.
- (ii) Weight loss in individual cases referred for medical opinion can be compared with the average weight loss as found in this study, and can be used in ascertaining the reliability of weight loss as an early sign of anxiety states.

Acknowledgments

I am indebted to Air Vice Marshal Sir Charles P. Symonds and Professor A. Bradford Hill for their advice on the treatment and interpretation of the results. I am also grateful to Wing Commander G. O. Williams for his collaboration in the sickness study, and to Dr. G. M. Morant for help with the anthropometric data.

TABLE IX

Mean weights of operational flying personnel

Sorties	Pilots		Navigators		B/Aimers		W/Operators		F/Engineers		M/U Gunners		R/Gunners	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
0	103	157·04	159	156·17	148	157·10	140	152·72	168	153·44	147	154·04	167	151·58
1– 4	216	157·22	234	156·80	231	154·91	241	151·04	235	149·36	223	150·56	233	150·80
5– 8	204	156·38	203	155·99	197	155·36	188	148·34	197	149·18	188	151·04	193	151·01
9–12	175	156·65	164	154·64	163	154·64	161	149·27	160	147·92	173	151·61	168	152·03
13–18	207	158·54	199	155·24	201	155·93	199	150·05	194	150·83	184	150·62	193	148·34
19–30	236	157·61	235	154·07	230	155·63	230	150·80	225	150·65	201	149·57	220	150·80
31†	21	153·71	26	151·64	17	158·36	17	148·46	25	156·32	16	148·64	21	150·26
Totals	1,162	157·22	1,220	155·39	1,187	155·39	1,176	150·35	1,204	150·32	1,132	151·07	1,195	150·71

TABLE X

Mean heights of operational flying personnel

Sorties	Pilots		Navigators		B/Aimers		W/Operators		Engineers		M/U Gunners		R/Gunners	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
0	100	69·76	156	69·27	148	68·90	138	68·57	167	68·38	147	68·52	166	68·37
1– 4	214	69·67	236	69·35	231	68·70	241	68·32	233	68·13	222	68·41	233	68·34
5– 8	200	69·67	203	69·37	195	69·34	188	68·22	195	68·15	187	68·51	191	68·09
9–12	171	69·77	162	69·26	163	68·88	158	68·23	159	68·13	171	68·32	168	68·29
13–18	204	69·61	198	69·41	197	69·27	200	68·13	191	68·43	184	68·25	192	68·20
19–30	233	69·66	230	69·20	229	69·04	228	68·26	225	68·29	198	68·28	218	68·44
31†	17	68·59	23	68·83	17	68·88	17	68·76	25	68·84	16	68·44	21	68·48
Totals	1,139	69·66	1,208	69·30	1,180	69·02	1,170	68·28	1,195	68·26	1,125	68·38	1,189	68·30

TABLE XI

Mean ages of operational flying personnel

Sorties	Pilots		Navigators		B/Aimers		W/Operators		F/Engineers		M/U Gunners		R/Gunners	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
0	102	26·59	159	25·01	147	24·66	140	23·37	168	23·86	148	24·03	167	23·06
1– 4	214	24·96	235	25·80	231	24·59	240	23·58	235	23·96	222	23·52	232	23·63
5– 8	205	24·34	203	25·03	197	24·61	188	23·59	197	22·75	188	23·56	193	23·53
9–12	174	24·71	164	24·68	163	24·50	161	23·51	160	23·44	173	23·31	168	23·53
13–18	207	24·46	199	24·86	202	24·90	199	23·60	194	23·07	184	23·40	193	23·83
19–30	236	24·26	235	25·41	230	24·48	230	23·63	225	23·25	201	23·57	220	24·04
31†	22	26·23	26	26·08	17	26·15	17	24·15	25	26·26	16	25·94	21	25·40
Totals	1,160	24·57	1,221	25·20	1,187	24·65	1,175	23·99	1,204	23·27	1,132	23·56	1,194	23·52

TABLE XII

Standard deviations of heights and weights of operational flying personnel

	Weight							Height						
Sorties	Pilot	Nav.	B/Aimer	W/Ops.	F/Eng.	M/Gnr.	R/Gnr.	Pilot	Nav.	B/Aimer	W/Op.	F/Eng.	M/Gnr.	R/Gnr.
0	14·87	15·52	15·19	14·07	15·14	16·22	14·28	2·28	2·37	1·98	2·27	2·73	2·33	2·14
1– 4	16·22	16·96	16·11	14·78	15·09	13·29	15·24	2·10	2·44	2·50	2·32	2·53	2·39	2·40
5– 8	15·95	18·33	15·81	14·80	14·64	15·10	14·31	2·26	2·80	2·26	2·14	2·45	2·40	2·05
9–12	14·25	14·38	16·52	15·21	15·11	15·13	14·92	1·92	2·12	2·60	2·49	2·55	2·32	2·23
13–18	15·92	15·64	15·20	14·90	15·45	13·87	15·61	2·13	2·31	2·26	2·30	2·45	2·32	2·41
19–30	15·45	17·92	16·62	15·25	15·26	14·98	14·12	2·39	2·59	2·52	2·13	2·58	2·15	2·31

Note.—The small discrepancies in numbers of subjects in Tables **IX**, **X**, **XI** are due to non-completion of the self-coding form in respect of the measurement concerned. The standard deviations in Table D are based upon the same numbers as in Tables **IX** and **X**.

CHAPTER XX

EPISODES OF UNCONSCIOUSNESS CONFUSION, AND AMNESIA WHILE FLYING

by

Wing Commander Denis J. Williams, D.Sc., M.D., F.R.C.P.

FPRC Report 562, November, 1943

Introduction

There has been a natural tendency to attribute impairment of consciousness in the air to the special physical conditions of wartime flying. Many cases have consequently been referred to the R.A.F. Institute of Aviation Medicine, Farnborough, but as a rule the investigations there have given negative results and reconstruction of the physical conditions have failed to reproduce the symptoms described by the patient. The effects of altitude, especially anoxia, and of centrifugal acceleration have been explored but more often than not the subjects' responses have been perfectly normal. The patients have then been referred to the clinical specialists, but again many have remained undiagnosed, when no physical cause has been found. This is disquieting, for periods of impaired consciousness, confusion, or amnesia while flying are by no means uncommon and their results may be catastrophic.

It seems that the difficulty in diagnosis rests mainly on four circumstances :—

(*a*) The syndromes are obscure and do not fit into a clear-cut clinical picture.

(*b*) There are often no witnesses and what evidence is available is circumstantial.

(*c*) Since the man who has lost consciousness is usually removed from flying, the exact aetiological diagnosis does not affect the practical issue of the disposal.

(*d*) Attention has too often been directed to special conditions and to special investigations, and away from a consideration of the whole patient in relation to his total physical and psychological environment.

It is the purpose of this report to examine the last cause in some detail and to consider all the factors responsible for impairment of consciousness in a consecutive group of patients.

1. Material and method

When known environmental causes such as anoxia, carbon monoxide or increased ' g ' had not operated, and special investigations had given negative results there often seemed so little evidence upon the cause of the unsconsciousness that such generic titles as *syncope of unknown origin* or *observation unconsciousness* were accepted. In a few of these cases, where other methods had failed, the electro-encephalogram had helped in establishing the diagnosis when the attack resulted from epilepsy, so Air Ministry instructions were issued to all commands in July, 1942 that " *in the case of a pilot or other member of aircrew who has an attack of faintness or disturbance of consciousness in the air, as evidenced by his own description of the attack, the account of witnesses, or* *the unexplained loss of height, the station medical officer concerned should arrange an appointment for the individual to have an electro-encephalogram* before any other executive action was taken." This presented an ideal opportunity for studying in detail a large and unselected series of cases of impairment of consciousness while flying.

This report is based on the examination of 100 consecutive cases of flying personnel who had an episode of unconsciousness, confusion, or amnesia while flying. The patients were referred by the unit medical officer shortly after the attack in the air had been brought to his notice. This usually preceded any other investigations. The subjects were consequently drawn from all stages of training, all duties, and had all degrees of experience of operations, in fact, they were quite unselected. A third were commissioned, 9 per cent were instructors or staff pilots, 15 per cent were under training, and 76 per cent were from squadrons. Each patient was interviewed and examined by me within a few days of the impairment of consciousness. The interview followed the usual clinical psychiatric lines and included a complete physical examination. The patient was investigated by electro-encephalography, further information was sought from his station when necessary, and where possible witnesses' accounts and executive reports were obtained. In some cases the investigations included high altitude testing with anoxia-meter readings, blood-gas estimations and clinical observation and in many other instances the patient was subjected to a decompression test at his station. After the interview the patients were referred to No. 1 Central Medical Board and the results of subsequent examination scrutinised.

The patients are divided according to diagnosis; the symptom pattern, diagnostic features and aetiological factors of each of the diagnostic groups are discussed. Short notes of cases illustrating the groups are contained on pages 275–281, only the most brief account appearing in the text.

2. Results

The 100 cases are divided according to diagnosis in Table I. It will be seen that this division is made entirely upon an aetiological basis, and Table II shows that in 10 cases two mechanisms were recognised. It will be shown later than in other cases such a dual mechanism may have been present but not recognised. The most profitable way in which to divide states of impaired consciousness or of amnesia is upon the basis of causation, for the most significant clinical features of the syndromes are negative ones—the absence of consciousness, the absence of awareness, or the absence of recall—so that conditions of very different origin may simulate each other closely. For instance, it may be quite impossible upon the evidence available to distinguish between a fugue state caused by epilepsy and one caused psychologically; and states of unconsciousness or confusion caused by anoxia, epilepsy, or even a head injury may at the time be indistinguishable. Knowledge of the difficulties of diagnosis in this particular field make it evident that all these diagnoses are not necessarily correct, and indeed in 12 of the 100 cases an absolute diagnosis was not made, for nine were considered to be probably epileptic and three to be probably due to cardiovascular instability, although evidence was not sufficiently strong to make a diagnosis certain. In the 23 cases in which an absolute diagnosis of epilepsy was made, the evidence was strong and was in most instances supported by a past history of fits or by a witness's account of the attack.

In the group of 55 patients with neuroses the diagnosis was in each case reasonably certain, for, as all the cases were seen within a few days of the attack, recovery had not taken place and symptoms of the disorder were still present. Although the psychiatric diagnosis could therefore be made with some confidence, it should not be inferred that the neurosis was necessarily the direct cause of the impairment in consciousness. This point will be dealt with later and indeed it forms the nucleus of the report. Conversely, although in 57 per cent a psychological disorder was discovered it may well be that in other cases a mild neurosis was present but was not discovered during the single interview.

In the subjects of anoxia due to mechanical failure and of carbon monoxide poisoning, technical reports supported the diagnosis.

Table I shows that the most common single disorder related to the impairment of consciousness or of memory was a psychological one, since this was recognised as causal in 57 cases. It is important to observe that in only 10 instances was the explanation to be found in a period of hysterical amnesia, for the nature and causes of the disturbance in the other cases of this group of psychological disorders provide the main problem for discussion. As it will be shown that in many of these cases there are several contributory causes resulting in a complex aetiological picture, it will be best to consider the groups of cases with more simple causation first. In this way a foundation will be laid for the discussion of the larger and most important group, since some of the single factors arising in the smaller groups will also be found to be operative in a more complex manner in the cases with psychological disorder.

TABLE I

Aetiological classification

Diagnoses	No. of cases	
Psychogenic :		
Fear or anxiety state	43	
Panic state	2	
Hysteria	10	
Fatigue state	2	
		57
Epileptic :		
Epilepsy (including symptomatic)	23	
Probable epilepsy	9	
		32
Oxygen lack :		
Oxygen lack (true)	4	
Oxygen lack (susceptibility)	4	
		8
Cardiovascular :		
Cardiovascular	1	
Probable cardiovascular	3	
Blackout at low ' g '	3	
Severe pain (barotrauma)	2	
		9
Vertigo of aural origin		3
Carbon monoxide poisoning		1
Total cases		110*

* 10 of these were mixed

TABLE II

Mixed syndromes

Fear or anxiety states with epilepsy	8
Fatigue states with vasomotor instability ..	2
Total	10
Fear or anxiety states with hyper-ventilation	15

3. Epilepsy

It is more difficult to diagnose epilepsy in the Services than in civilian practice since reliable witnesses' accounts are often absent and relatives cannot be interrogated. The difficulties of witnessing an attack in the air are obvious. Nevertheless, the diagnosis was made confidently in a quarter of all the cases, and tentatively in another 9, bringing the number in which epilepsy was present or suspected to a third of the total.

Although the diagnosis of epilepsy in general need not be discussed, there are some guiding signs which can be used in diagnosing epilepsy in the air, in addition to the accepted criteria of the pattern of the attack, such as its sudden onset, incontinence, tongue biting and so on, which are worth mention. First, there has often been more than one attack, the earlier ones which were perhaps less serious being concealed by the patient. Secondly, they often appear in a man who is well adjusted to his job in whom no extraneous psychological, physical or mechanical cause can be found. Thirdly, they tend to have catastrophic results and the man only survives by sheer good fortune since he is quite unable to control the time of onset of the attack. Fourthly, they are not necessarily related to high altitude flying but are the most common cause of unconsciousness in the air in men under training. Fifthly, the electro-encephalogram (E.E.G.) will support the diagnosis in nearly half of the cases.

Epilepsy is the cause of unconsciousness in an alarmingly high proportion of cases, considering the efforts which are made by medical selection boards to reject the epileptic. As several cases of loss of consciousness in the air have been seen each week, the impression has been gained that the incidence of fits in the air is unexpectedly high. Applying statistics derived from the total population one would not expect more than one epileptic in about 500 healthy aircrew, since the incidence of epilepsy in an unselected population is about 1 in 200 (Lennox, 1941). All things being equal, most would have their fits on the ground, since the relative time in the air is very short, and the attacks which lead to a catastrophic end would not come to the notice of the medical branch. The ease with which 32 cases of fits in the air have been collected in a few months consequently suggests the operation of some special precipitating factors. This view is supported by the observation that the cases of epilepsy fall into two groups : first, those with a previous history of attacks, and second those who through special conditions encountered in their duty have their first attack while flying. The special precipitating factors in the second group may be physical ones such as the conditions found at high altitude, or psychological, as in the case of men who are acutely afraid. There may well be no previous history of epilepsy in these patients, for a special sequence of events was required to produce the fit they had. A single fit may occur in normal men on ground duties as a result of special circumstances arising in war, for examples are seen in the apparently normal men who have a convulsion after fatigue and prolonged hunger. This is particularly common in infantry duties and is seen in men who remain awake for 36 hours with night guard duty.

The circumstances in which the attack occurs in the air depend upon the duties of the man and his place in the crew and the sequels are quite different in single and multi-engined aircraft. In single seaters a period of unconsciousness usually results in an unexplained loss of height (Case 7 of the Appendix), or in an unexplained crash and in these the only kind of attack compatible with survival is *petit mal* or any other short-lived attack. As a quarter of those who survive a period of unconsciousness in the air have had an epileptic fit, one may reflect upon the number of unexplained crashes which may have been due to an epileptic attack which lasted too long. In multi-engined aircraft, the attention of the crew may be drawn to the pilot by the unusual behaviour of the aircraft, and a common story is that of the bomb aimer or navigator having to take over the controls, often pulling the pilot away from the control column over which he had slumped. Other members of the crew are less likely to be observed in the attack itself and they are usually found unconscious after failing to reply over the intercomm. A typical short attack in a fighter pilot was seen in Case 7.

Case 7: *Brief epileptic attacks in a fighter pilot* (page 275). Four brief periods of interruption in consciousness occurred at heights from 300 to 11,000 feet with and without oxygen in an apparently healthy, well-adjusted man in whom there were no previous symptoms. There was no warning in the last three and there were no sequelae, the patient merely being aware of an interruption in the stream of consciousness. The E.E.G. suggested epilepsy. This case illustrates many of the diagnostic points in relation to epilepsy in fighters. In contrast is Case 88 (page 285).

Case 88: *Epileptic attacks in an air gunner* (page 281). Two epileptic attacks occurred with and without oxygen in the air, in an unstable man who had had *petit mal* attacks for 18 months. His mother had similar attacks, and his E.E.G. was characteristic of epilepsy. The man's disability came to notice through his failure to reply over the intercomm.

These two cases are examples of epileptic attacks occurring without obvious cause in predisposed persons, in whom the E.E.G. showed a dysrhythmia. The second group of patients, those who have a fit as a result of special conditions encountered in their duty, will now be considered.

No case of a fit occurring as a direct result of the physical effects of high altitude, anoxia, or 'g' has been encountered, although the possibility is discussed in relation to a case of anoxia on page 275, but in several emotion appeared to have been the precipitating factor.

4. Epilepsy caused by fear

Fear may give rise to epileptic attacks in two ways:

(*a*) *Directly*, by producing so-called *reflex epilepsy*. Examples of this sort of specific trigger are not uncommon in civilian practice where cases occur in which fits only follow immersion of the left foot in cold water, cutting the hand, hearing organ music, or experiencing an uncontrolled outburst of anger, and Case 23 may be an example of this. In his book on *Fear*, published in 1884, Mosso clearly describes a case of a boy in whom epileptic fits were precipitated by emotion.

Case 23: (page 276) is that of an air gunner who had a fit at 15,000 feet on his first operational sortie. It was an unusually hazardous trip, and he had been at 15,000 feet many times before. It was thought that an acute fear state had culminated in a fit in a person whose E.E.G. suggested that he was predisposed to epilepsy.

(*b*) *Indirectly*, by producing secondary physical changes. It is suggested that in war time flying this occurs when fear, usually superimposed upon an anxiety state, causes hyper-ventilation which results in a profound fall in the alveolar and blood carbon dioxide content. The aetiology and symptomatology of this state is dealt with on pp. 270-271 where fear and anxiety states are discussed, but Hinshaw and his co-workers (1941) have described the hyper-ventilation syndrome in civil aviators. It is a commonplace that in the epileptic subject a fall in blood carbon dioxide is an effective cause of epileptic attacks and indeed a period of quiet overbreathing is used as a routine to produce larval epileptic outbursts in patients suspected of having epilepsy during investigation by the E.E.G. The unconscious overbreathing associated with prolonged fear which will be dealt with later might be expected to maintain a more sustained and severe fall in carbon dioxide than the voluntary short periods of overbreathing used in the laboratory. This mechanism for the production of a fit was encountered in several cases in the present series, and Case 66 is a striking example of it, making further description unnecessary.

Case 66 : *Fear causing an epileptic fit* (pp. 278–279). An air gunner had had fits between the ages of 12 to 17 preceded by praecordial pain and precipitated by fear-provoking stimuli. There was a maternal history of epilepsy. He had two similar attacks in the air immediately after experiencing fear which was associated with the usual somatic accompaniments of dry mouth, sweating and respiratory changes. He also had air hunger. On the second occasion, at 13,000 feet, on a raid on Kiel, he was seen in a convulsion. The syndrome was reproduced at the equivalent of 15,000 feet on oxygen in a chamber, when there was spontaneous unconscious hyper-ventilation, reaching 100 a minute, associated with greatly increased ventilation rate and low blood carbon dioxide. It is suggested that an epileptic fit was produced in a susceptible person by acapnia resulting from hyper-ventilation, which accompanied an acute fear state over enemy territory.

Besides idiopathic epilepsy and epilepsy resulting as a direct or indirect effect of emotion, the usual physical causes of epilepsy must be remembered. A dramatic example of this occurred in the following case.

Case 6 : *Symptomatic epilepsy simulating panic in an air gunner.*—In a Stirling at 12,000 feet over enemy territory the rear gunner reported flak and searchlights in great concentration to starboard. Evasive action was taken, but this observation was not confirmed. He reported it again and then did not answer over the intercomm., which was switched on and transmitted stertorous breath sounds. The W.Os./A.G. went back to find the rear gunner apparently unconscious. He recovered on the rest couch after 20 minutes. On landing at base, weakness of the right side which was found, but which rapidly disappeared, was thought to be hysterical and the whole episode attributed to panic. He had, in fact, a left temporo-occipital lesion (which on electro-encephalography produced an area of abnormal high voltage slow waves over the left posterior temporal region) the first sign of which was a fit with a visual aura of bright lights in the right homonymous field, which was followed by a right-sided post epileptic paralysis. The nature of the lesion has not been determined as the patient refused full investigation. It is probably a tumour.

It has been said that epileptic attacks while flying may occur as a result of specific factors. The commonest of these has been found to be a psychological disorder resulting from fear. This subject is discussed later in relation to anxiety states and fear states.

5. Cardiovascular instability

(a) Fainting of cardiovascular origin

Vaso-vagal attacks, or periods of unconsciousness of cardiovascular origin, rarely occur in the sitting position and in only one case in this series of 100 did it seem likely that this had occurred in the absence of rapid changes in gravity.

Case 67 : *Impairment of consciousness of cardiovascular origin* (page 279).—A pilot with poor cardiovascular regulation who became liable to faint in stuffy rooms and on change of posture, had faint feelings without actual loss of consciousness while flying. The attacks ceased when his general health improved. From the character of the attacks, his physical signs, and his improvement with treatment, they were thought to be cardiovascular in origin.

(b) Blacking-out at low 'g'

Although loss of consciousness from simple cardiovascular causes while in the air has not been encountered, there is a very interesting group of cases in which vasomotor efficiency is lowered as a result of a fatigue state, and in which the inefficiency becomes evident as a diminished tolerance to 'g'. The association of cardiovascular instability with neurosis is well recognised. It is responsible for the flushing and fainting of the subjects of anxiety states and fatigue states, and the postural vertigo and fainting of the patient with a post-traumatic cerebral state may well have a similar cardiovascular origin. This investigation shows that it may be a very early sign of the disorder, for it may be elicited by alterations in 'g' while flying. It seems that in these states on the ground, the vasomotor system fails to adjust efficiently to a sudden change of posture, the vertigo and faintness being produced by cerebral anaemia resulting from a diminished cardiac output. Centrifugal acceleration will produce exactly the same train of events in a cardiovascular system which is efficient enough to respond satisfactorily to postural changes. The cardiovascular instability consequently causes a gradual lowering of the threshold to 'g', in the earlier stages, but as the condition progresses there is ultimately fainting without any change of gravity. The lowering of the threshold is associated with other symptoms of an anxiety or fatigue state. The whole syndrome is well illustrated in the following case.

> Case 100: (page 281.)—An excellent officer developed a fatigue state, leading to anxiety, as a result of exhaustion caused by a long period of flying instruction. As the neurosis developed, his tolerance for 'g' gradually diminished until he blacked out, and became unconscious with a slight change in centrifugal acceleration. He then fainted for the first time in response to pain. He showed the syndrome of deterioration in cardiovascular control associated with a fatigue state, caused by exhaustion.

6. Fainting through pain (barotrauma)

There were two instances of men who had unbearable pain in the ears during a rapid dive which led to a short period of unconsciousness. In neither was there any evidence of neurosis, predisposition to neurosis or of a family or personal history of epilepsy. The exact mechanism of the production of unconsciousness is unknown, but it seems likely that a cardiovascular response to the aural pain was responsible for a great fall in blood pressure. A cardiac depressor response of this sort is recognised to occur in external stimulation of sensory cranial nerves. Case 48 is an example (page 277) of a solitary faint at the height of aural pain due to diving at speed in a man with blocked Eustachian tuber. Bradycardia has been observed during the attack in one of these cases, which consequently come under the same heading as the others in this section.

7. Aural vertigo

Impairment of consciousness, usually not amounting to anything more than confusion, may sometimes complicate a severe attack of aural vertigo. Even true unconsciousness may occur at the height of an attack, but a period of confusion during which the subject is unable to appreciate his environment or to control his actions is not uncommon. In usual circumstances this slight confusion may pass unnoticed, particularly if the patient is sitting or lying unoccupied. In such an exacting task as that of a pilot the period of confusion interrupts a succession of skilled movements, and so becomes evident. Two examples were found in the present series. In both there was a previous history of attacks of vertigo on the ground, and in the attacks in the air there was vertigo, rotation of objects and nausea before the confused period, and in both there was evidence of aural abnormality. The diagnosis of the condition, which is not related to altitude, is usually simple since the pattern of the attacks is so characteristic; Case 69, in which confusion complicated vertigo (page 279) is an example of this. It was that of a pilot who had had similar attacks on the ground and who had stereotyped and brief attacks of vertigo and confusion while flying. He had slight middle ear deafness on both sides. He nearly flew his aircraft into the ground in one of the attacks. The third example of vertigo (Table I) was that of a Spitfire pilot who had his only attack, the pattern of which was similar to that described in the case above, when bending down quickly in his cockpit to adjust his compass.

8. Oxygen lack

This chapter, of course, *only deals with men who have survived* a period of unconsciousness in the air, and true oxygen lack appears to be uncommon in these men under the conditions which exist in the R.A.F. at present, but it might be well to observe that during the same period of time fatal examples have occurred. On the other hand, many of the patients blame the oxygen supply for their period of unconsciousness, but in most cases technical investigation at the time and afterwards fails to show any defect, and the medical evidence fails to support the patient's contention. This is not always conclusive, for freezing of masks must be considered and transitory anoxia may leave no sequelae.

Of the four cases with oxygen lack, unconsciousness had occurred at over 35,000 feet in two, at 32,000 feet in one, and at 26,500 feet with exercise in the fourth. The first three were in fighters, and they gave a typical story of gradually increasing confusion and disorientation leading to unconsciousness, with recovery in a rapid dive at under 10,000 feet. The fourth, Case 99, was a flight engineer working at 26,000 feet on a portable oxygen bottle which proved empty. He was found very cyanosed, and did not recover consciousness for 50 minutes after going on to oxygen. There was stertorous breathing during this time, he was twitching after recovery, and was confused and amnesic for eight hours afterwards. Two hours after the anoxia, while still confused and disorientated, full examination of the central nervous system showed no abnormal physical signs. Subsequent decompression testing at 30,000 feet with and without oxygen showed normal responses. It may be that this N.C.O. had a convulsion while anoxic, but the long period of unconsciousness and of subsequent confusion and amnesia with rapid recovery has been seen in several cases of uncomplicated anoxia. In one, where the anoxia was profound and prolonged, amnesia lasted for three days and included a period of retrograde amnesia. There was subsequent intellectual and memory defect with a personality change indistinguishable from that seen after a head injury. Recovery was, however, rapid and complete.

9. Susceptibility to oxygen lack

In three instances unconsciousness occurred and seemed, on strong circumstantial evidence, to have been due to oxygen lack, but in each case unconsciousness seemed to have supervened at inadequate height, i.e. 12,000, 13,000, 16,000 and 19,000 feet. In each of these instances another contributory factor may have been operative, but it is certain that at the heights quoted the patients were receiving no oxygen through their masks. Particularly in the first two instances, where the subjects were air gunners, cold may have contributed. A précis of the significant points in each history (Cases 2, 58 and 62) is on pages 275 and 277. The four men were all found with impaired consciousness and with inadequate oxygen, at comparatively low altitude. In the first, no explanation can be offered. In the second, there had been great failure as well as anoxia and a high blood pressure. In the third, there was anoxia with hyper-ventilation and probably anxiety, and in the fourth there was anoxia with an innate vulnerability to low oxygen tension. The E.E.G. was normal in all and there was no history of previous faints or fits in any. Since this was written other cases of unconsciousness associated with failure of the oxygen supply at

15,000 feet or less have come to notice. They occurred in conditions of cold in Flying Fortresses. It may well be therefore that the critical height for unconsciousness due to anoxia is lower in some subjects than is usually held.

It is explained on page 270 that some of the 43 cases of unconsciousness associated with acute fear or anoxia were associated with hyper-ventilation, and that this can cause a fall in inspired oxygen if an economiser is used, while a diminution in the power of dissociation of oxyhaemoglobin due to the lowered blood carbon dioxide content, which may be profound, lowers the tissue oxygen tension still further. Added to this there appears to be in some unusual instances, as in Case 2, an unexplained vulnerability to low oxygen tension. The four cases which have been described were examples of anoxia through instrumental causes, but it may well be that some of the other cases in which fear or anxiety was the prominent feature may have lost consciousness as a result of anoxia.

10. Psychological disorders

Subjects with neurosis comprise the largest and most difficult group of cases and it will be shown that in these there is evidence that the episode of disturbed consciousness was psychologically determined. The only psychogenic disorder of consciousness that comes to notice in civil practice is hysterical amnesia, but only ten of this series of cases fall under this heading. Sargant and Slater (1941) in discussing the amnesic syndromes in war, divided the psychogenic periods of amnesia into fugue states and simple amnesic gaps. The first are crude forms of escape from the present, adopted by obnormal personalities, while the second disorder 'is a simple protective mechanism by which the continued recollection and presence in consciousness of painful events is avoided.' Although cases are hysterical in so far as they offer a solution to the patients' problems, the first more often approaches malingering, if the distinction between the two can indeed be made with certainty. Although practically all of Sargant and Slater's cases fell into these two groups this was not so in the present series, for evidences of an hysterical aetiology were absent in most of the cases. Other mechanisms must therefore have been operating and it has been shown earlier that epileptic fits may occur as a result of fear, either directly or as the secondary result of other changes, notably emotional overbreathing. It is also possible that impairment of consciousness unassociated with epilepsy may be produced in the air as a result of the visceral changes resulting from fear while flying, and these mechanisms will be discussed further.

Although different reaction types have been recognised (see Table I) it must be realised that they did not necessarily appear in pure forms, and it is certain that all the instances of hysteria occurred in the subjects of fear or anxiety states.

(a) Anxiety states

This is by far the largest single sub-group of cases (43 per cent) and is the most interesting. In these and in the 10 per cent with hysteria the main precipitating cause of the illness was fear (*see* pages 164–166). In this group of cases the disorder was usually of recent onset and rapid progression, and in many an acute fear state (Sargant and Slater 1940, Love 1941, and Cooper and Sinclair 1942) was superimposed. Most of the patients were very much afraid, and their fear was most intense while in the air. Either the fear itself or the conflict which arose between their intense fear and their accepted standard of behaviour appears to have been the precipitating factor in causing the psychological disorder in most cases. Symonds (1943) has already dealt at length with the subject of the place of fear in causing anxiety states in air crews and other combatants, so that the psychological mechanisms involved will not be discussed further. Cases 39 and 64 (pages 276 and 278) are simple examples of the normal relationship of this fear and the ensuing anxiety state to a period of unconsciousness or amnesia.

> Case 39 was an example of unconsciousness caused by fear in a timid air gunner (Appendix). A timid, unstable, anxious man, both of whose parents were nervous and equally unstable, volunteered for aircrew. Great fear was experienced on the first two operational trips, and an acute anxiety state developed. He tried to escape from the third trip by reporting sick, but being sent on it, an acute fear state developed within an hour of taking off. He was seen to be sweating and overbreathing and has amnesia for the next 45 minutes. There is not enough evidence available to determine his state of consciousness or the intermediate mechanisms initiated by fear which produced it.

On careful questioning it became quite apparent that not only had many of the patients in this group been intensely afraid before they became unconscious, but that some of them had in fact been found deeply unconscious. Some, like those referred to later, were merely confused or amnesic, but many of these are excluded from the group of anxiety states, since those subjects who had had a behaviour change or amnesic period as a direct result of psychological factors, and in whom the mechanism appeared to be an escape from their fearful environment, were grouped under the heading of hysteria. In many of these an anxiety state was also present and in all a state of acute fear had occurred. The circumstances in which unconsciousness occurred in the first group of subjects was usually not dramatic, and frequently the man was simply found unconscious, perhaps in his turret or at his table. The commonest story was that no reply had been received on routine contact over the intercomm., and that when another member of the crew had gone to investigate, the patient was found slumped over his maps or guns, or was lying in his bomb aimer's position unconscious. Case 39 (page 276) is an example of this. When the pilot was the subject the story was that he had collapsed over the control column and the aircraft had gone out of control as in Case 64 (page 278), an example of unconsciousness caused by fear in a timid pilot. In this case an obsessional, intense pilot experienced severe stress in his first few operational sorties. It is probable that much of this was caused by pilot error, a result of his personal shortcomings. He developed an anxiety state which culminated in an acute anxiety attack with two periods of amnesia. From the patient's story the amnesia was short lived and was probably very superficial. The first was probably not hysterical but was a confusional state resulting from the acute fear he was experiencing.

In these last two cases the patients simply appeared to have lost consciousness, or to have been amnesic, but in eight cases clonic movements or a fully organised fit was witnessed as in Case 66 (page 278).

The direct relationship of the incidence of these fear states or anxiety states to the degree of danger encountered has been demonstrated on pages 168–170 and this relationship is shown in this series of cases by the fact that 75 per cent of the 57 men with psychological disorder were on operational trips at the time of their attack, while 60 per cent were on night bombing sorties, which have been shown to have the highest casualty and neurosis rate of all duties (Chapters IV and X). When the syndrome occurred in men under training it was usually associated with fear in a timid, anxious man, in circumstances which would not ordinarily be expected to cause such a degree of fear, as in Cases 15 and 42 (pages 275 and 277). It is characteristic that in these cases the patients were pathologically timid individuals and that their response to their easily evoked but intense fear was a period of hysterical amnesia (vide infra).

Case 14 was that of a pilot, aged 20, who had flown 4 hours under training. In each of his first three trips flying dual in a Tiger Moth he had felt tense, apprehensive and giddy, although he was simply flying straight and level. On the second trip the instructor saw that the pupil had suddenly fallen over the controls apparently unconscious, and he therefore made a hurried landing. He then found the pupil conscious, trembling and sweating profusely. He helped him out of the aircraft and noticed that he staggered as he walked away. The patient went up later, but asked to be brought down again. He had always been timid and anxious, and had had fainting attacks before. Full physical examination, including electro-encephalography, was normal, and although he was referred with a diagnosis of "vasovagal attacks," the Consultant in Medicine concluded that "the cause is obviously fear." This man was pathologically timid and had an acute fear reaction each time he flew, although he had an experienced and sympathetic instructor. In spite of the trivial cause for his fear he appeared to have an attack of unconsciousness. This may have really been loss of consciousness, but it is more probable, as he recovered on landing, that it was a period of transient confusion.

Other forms of pathological fear may similarly cause impairment of consciousness, as in the case of an officer who had a specific, irrational fear (a phobia) for altitude. He was in other respects an excellent pilot, but being forced to fly at 20,000 feet he had an attack of unconsciousness, which he attributed to anoxia, but which was apparently related to an anxiety state which his phobia had caused.

(b) Acute fear states

It has already been stated that many of these 43 patients seemed to have been genuinely unconscious, and that 8 are known to have been convulsed. Considering the difficulties of observation, it may be that more than this number had an epileptic fit. Those who had simple amnesic states were grouped under *hysteria* or *panic states*. Coma is not an integral part of an anxiety attack upon the ground however acute and intense the attack may be, although hysterical attacks often complicate the picture of an anxiety state. Yet the evidence seems to show that some of these subjects became unconscious in the face of fear. Some of them might have been in a stuporose state as a result of their fear and not have been in coma, but lack of expert observation makes the differentiation very difficult. The acute fear states encountered in land fighting in this war have been described by Sargant and Slater (1940) and others already quoted. Fear gives rise to profound physical disturbances, resulting from activity of the sympathetic nervous system in normal subjects, causing incontinence, vomiting, tachycardia, sweating and marked changes in the respiratory rate (Cannon 1915). Although these somatic accompaniments of the emotion of fear may be severe and very distressing, they do not produce unconsciousness, and it is difficult to see how they could. Even if a psychopathological mechanism of escape were postulated there would be difficulty in explaining unconsciousness of the depth seen, and with the physical accompaniments found in some of these cases, for there is a great gulf between amnesia or stupor and true coma.

It is reasonable to wonder whether with hyperventilation a secondary physical factor is also causal. Overbreathing is the most common change in respiratory rhythm found in anxiety and fear states (Christie, 1935) and this has long been recognised for a description of the respiratory increase of frightened animals was made sixty years ago by Mosso (1884). Interest in the subject has increased recently and many papers have been published (Finesinger, 1943). Rushmer, Boothby and Hinshaw (1941) and Uehlein and Boothby (1942) have drawn attention to prolonged hyperventilation among pilots and passengers during civil flying.

Having witnessed the respiratory changes in some of the patients of the present series, Goldie (1943) has recorded the respiration of a pilot during an actual bombing sortie. Even though the subject had carried out over 30 sorties for which he had been decorated, his respiration remained at an abnormally high rate all the way from base to the target. After that it fell, and reached a steady normal level after the French coast was passed. The hyperventilation was thought to be emotional for the observer, on his first operational trip, was recording his own respiration rate and found that it showed no corresponding changes. Case 62 (page 277) is an example of fear resulting in conscious hyperventilation, in which an air gunner, liable to fainting attacks, was conscious of overbreathing and of fear before losing consciousness at 16,000 feet on oxygen. No persisting physical cause was found for this unconsciousness. Deep breathing of this sort may be prolonged and may produce tetany, paraesthesiae, confusion and faintness, and even a state of collapse. Tetany occurred in Case 81 (page 280) and a hyperventilation syndrome identical with that which had previously been experienced in the air was reproduced by overbreathing in Cases 72 (page 280) and 66 (page 278).

Case 81 : *Fear with tetany* (page 280).—This is the case of a pilot who had a specific fear of night flying who developed tetany, presumably due to unconscious overbreathing associated with fear, while instrument flying. His fear had given rise to an anxiety state and the syndrome was reproduced by voluntary overbreathing.

Case 72: *Hyperventilation syndrome without admitted fear* (page 280).—Here an apparently stable, well-adjusted Spitfire pilot was prone to develop a syndrome which could be reproduced by hyperventilation. This only occurred on operations while wearing a mask, and began 15 minutes after take-off, at low altitude. It was always associated with conscious overbreathing. Although this airman denied fear, it is likely that this overbreathing on operations was emotional in origin, and his subsequent breakdown supports this view. He was a man in whom the somatic accompaniments of emotion were more evident than his awareness of it.

Sometimes the hyperventilation may be present as an early manifestation of fear, when the man does not admit to incapacitating fear and when he genuinely is not experiencing the emotion to an embarrassing degree. The bodily symptoms of fear may be much more intense than the subject's awareness of fear, and the description of tachycardia, pilomotor activity and slight visceral discomfort before a team game which has no real terrors is quite common. This phenomenon is well illustrated by the last case, in which there did not appear to be more than the usual degree of fear, although the visceral response was greater than average. Although hyperventilation of this sort is usually unconscious, five of ten patients in whom there was evidence of overbreathing were aware of its presence (Cases 62 and 72 (pages 277 and 280)). In the others the over-breathing was noticed by witnesses or the syndrome was reproduced by voluntary hyperventilation (Cases 66 and 72 (pages 277 and 280)). It will be seen later that there is some evidence that it took place unconsciously in others. It was striking to find how many of the periods of unconsciousness associated with fear had occurred at high altitude. The 53 cases were divided as in Table III.

TABLE III

Height in feet at which unconsciousness occurred (feet)

Height	Not known	Less than 1,000	1,000 to 10,000	10,000 to 15,000	15,000 to 20,000	Over 20,000
No. of cases ..	4	4	13	18	9	5

As already explained, it is difficult to imagine coma resulting as a direct result of emotion in the absence of epilepsy. Examples have been quoted of cases in which fear has been associated with unconsciousness or with frank convulsion. The story is that of a member of a crew using oxygen at something over 15,000 feet, very afraid, showing some symptoms of an anxiety state and having evidences of vulnerability to neurosis in his past history, who becomes unconscious for no demonstrable reason. When the subject overbreathes as a result of his fear he lowers his blood carbondioxide content, which causes a rise in the blood pH, and at the same time prevents full utilisation of the oxygen in the blood, by preventing dissociation of the oxygen from the oxyhaemoglobin (shift of the oxygen dissociation curve of haemoglobin to the left). This will lower the critical altitude at which the unconsciousness might supervene through anoxia. These men will breathe oxygen set for 5,000 feet higher than their height, through an economiser. The economiser supplies a fixed amount of oxygen per minute. If rapid shallow respiration occurs the percentage of oxygen in the respirate may be lowered and as a result significant anoxia can occur when hyperventilating in a circuit which includes an economiser (Matthews 1943). The low carbondioxide further enhances the tissue anoxia, and the activity associated with an acute fear state will increase the consumption of tissue oxygen. Thus even when the subject is breathing oxygen, unconsciousness due to tissue anoxia may occur above a critical height—somewhere above 15,000 to 20,000 feet, which varies from subject to subject. A case in which many of these factors were operative was number 74 (page 280), in which unconsciousness complicated a fear state at high altitude. This case is an example of a severely predisposed man who developed an anxiety state as a result of considerable stress. He had an attack of deep unconsciousness with urinary incontinence as a culmination of an acute fear state, while breathing oxygen at 17,000 feet. It is impossible to state the exact nature of the unconsciousness. The only positive evidence in favour of epilepsy was the incontinence, but his bladder had been full for two hours and in these circumstances incontinence would occur with unconsciousness of any cause. There was no evidence that the attack was hysterical and under narcosis during which the patient co-operated well, the period of amnesia could not be penetrated. There seems no doubt that the man was profoundly unconscious and not merely amnesic.

It seems possible that while some patients have an epileptic fit as a result of overbreathing, some become unconscious through anoxia at an unusually low altitude—this usually applies particularly to those in the neighbourhood of 20,000 feet or over, but cases have been described earlier in which coma has supervened at 15,000 feet. It seems apparent that it is impossible to divide the psychological from the physical factors in these cases, and that the physical factors are also intimately united to each other. For instance, the epileptic fit depends as much upon an innate tendency to periodic unconsciousness as it does upon external factors such as acapnia and anoxia, while the initial effect of the emotion of fear upon the individual depends upon a host of variables. Of these, the degree of the affect, the conflict it arouses, the subject's predisposition to neurosis, the form that the neurosis may take, and the somatic changes which accompany it all seem important. Finally the precipitating psychological causes depend for their effect upon their time relation to the basic psychological disorder and upon many physical accompaniments in the environment, such as the height, temperature, degree of fatigue, or even time after the last meal at which an acute fear state arises. It will be seen therefore that in the assessment of this group of cases all the information derived from clinical examinations, psychiatric interview, physiological investigation and executive report must be co-ordinated. Careful examination of one aspect only will almost certainly yield negative results.

(c) Fear with hysteria

A period of hysterical behaviour with amnesia while flying is more likely to appear in relatively inexperienced members of aircrew. Half the present cases of hysteria were under training at the time of the attack. In attributing amnesia to hysteria not only must there be no adequate physical cause for the amnesia, but there should be evidence of hysterical features in the patient's background and an adequate cause for the hysterical reaction; since by definition hysteria is a "condition in which mental and physical symptoms not of organic origin are produced and maintained by motives never fully conscious, directed at some real or fancied gain to be derived from such symptoms." (Medical Research Council War Memorandum No. 4 1941.) Furthermore the amnesia in most cases should be readily recoverable under hypnosis, although failure to recover the amnesic period does not preclude hysteria. Lack of evidence makes diagnosis difficult but it is likely that in the light of experience the diagnosis of hysteria in past cases of this sort could be reviewed with advantage. The hysterical attack may occur at any height, though it is often at relatively low altitudes, seven of the ten cases occurred in pilots, and fear was present at the time of the attack in all the cases. An undoubted example of the syndrome in a man under training is shown in Case 15 (page 275) where an hysterical attack occurred in a timid pilot under training. The simple hysterical reaction described in this man is analogous to the cases of hysterical amnesia described among Army personnel by Sargant and Slater (1941). In these men the stuporose or amnesic period was thought to have arisen as a means of escape from the dangerous environment. At the other end of the scale is the experienced pilot who has an attack of hysterical amnesia on operations, in order to escape from the memory of an unpleasant situation, often complicated by the knowledge that he cannot stand up to his fear. This mechanism seems to have operated in Case 42 (page 277).

(d) Fear with panic.

When a state of panic arises, in the air or on the ground, the subject is likely to have amnesia for the episode. This may either be an hysterical amnesia or loss of recall, which extends beyond the short period of panic, or it may be an amnesia caused by loss of attention, for the man may be so totally preoccupied with his panic that he does not register any of the changes in his environment, so that he had nothing to remember except the indefinite confusion of the panic. Whichever mechanism is in force a panic state may simulate other disorders, particularly epilepsy, and it is often overlaid by hysteria. This was so in Case 17 (page 276) where there were repeated attacks caused by panic. In this case, where a grossly unsuitable man had three attacks of pain on operational flights, the amnesia for the attacks was probably based upon a failure of attention resulting from the panic, but overlaying it was a very superficial desire to forget the dishonourable episodes, leading to a shallow or perhaps simulated amnesia.

11. Summary and conclusions

A hundred consecutive cases of flying personnel who have become unconscious, confused or amnesic while flying have been investigated. They were unselected and came from all kinds of duty, but three quarters of the patients had the attack while on operations.

A neurosis was recognised in 57 per cent while epilepsy was recognised in 23 per cent and suspected in another 9 per cent (32 per cent in all). True oxygen lack was the cause in only 4 per cent, and other causes were oxygen lack with personal susceptibility (4 per cent), cardiovascular changes (4 per cent), aural vertigo, blacking out at low 'g', barotrauma, and carbon monoxide poisoning. In some cases the syndrome was a mixed one, a neurosis being associated with epilepsy or cardiovascular instability.

By far the most common primary cause of impairment of consciousness in the air was *a neurosis, usually an anxiety state,* and the most frequent cause of this was fear. This gave rise to impairment of consciousness or recall in the following ways :—

(1) By causing an *epileptic fit* in a predisposed person, either directly in response to emotion, so-called reflex epilepsy, or by indirect methods. Evidence is presented that the most frequent indirect method is by the emotional hyperventilation which may accompany fear, leading to a great fall in the blood carbon dioxide content, and the onset of a fit.

(2) By causing *hyperventilation* at altitude, which in appropriate conditions will result in anoxia, and acapnia, leading to a state of impaired consciousness without a fit. In some cases it seems that this can occur even while the subject is receiving oxygen.

(3) By producing an *hysterical state* of stupor or amnesia.

(4) By causing *panic* during which the subject is unable to appreciate events and so is amnesic.

(5) By producing secondary *cardiovascular inefficiency* which may cause syncope or blacking out at low 'g'.

The important part played by fear in these syndromes is illustrated by the high proportion of them that occur on operational flying, particularly night bombing, as well as by the subjects' introspective accounts.

An *epileptic fit* is probably responsible in a third of the cases. There may or may not be a previous history of fits. The story of epilepsy in the pilot of a single-seater aircraft differs from that in aircrew, since the only fighter pilots who survive are those with short attacks. The epileptic attack may be without apparent cause, may be associated with an anxiety state as above, or may be symtomatic of other disorders.

Syncope due to cardiovascular instability is rare unless it is a symptom of a neurosis. It may be induced by posture, slight alterations in 'g', or the severe aural pain caused by barotrauma.

Aural vertigo may cause confusion, which is much more evident when it interrupts skilled performance in the air than it is on the ground. Aural pain due to barotrauma may cause unconsciousness.

Oxygen lack is uncommon, although it is frequently incriminated falsely. There is usually technical confirmation of its presence. Some subjects lose consciousness with anoxia at unexpectedly low altitude, but there seem to be other contributory causes in these cases.

Carbon monoxide poisoning is rare but presents a characteristic picture.

It is difficult in many cases to establish the exact causes of impairment of consciousness while flying, because of the lack of available clinical evidence. If only a single cause is sought the diagnosis is even more difficult, for most of the cases present a complicated picture in which a neurosis caused by fear is primary while impairment of consciousness results from secondary physical causes.

The correct diagnosis of the case of unconsciousness or amnesia while flying depends more often upon study of the whole patient than it does upon detailed investigation of one aspect of the problem.

12. **Addendum**

Summary of a report to the Director-General of Medical Services, Royal Air Force, upon the use of the electro-encephalogram in rejecting potential epileptics among air crew under training

In about half the cases in this series diagnosed as epileptic, the E.E.G. showed characteristic changes. This corresponds with the finding in an unselected series of epileptics in the service of *larval attacks* in 27 per cent, and less distinctive paroxysmal outbursts in 29 per cent. In a population without clinical evidence of epilepsy *larval attacks* are absent and other paroxysmal outbursts present in 0·8 per cent. If every subject with a paroxysmal outburst is considered to be a potential epileptic, rejection of 1 in 100 trainees by E.E.G. might elimnate half the potential epileptics.

One E.E.G. unit (one instrument, a trained technician and a clerk) could examine 20 or 25 men a day (maximum of 500 a month), so that, supposing the monthly intake to be 8,000 personnel, about 15 E.E.G. would be needed. About 5 per cent (400) of all records would have to be scrutinised by an expert each month to select 1 per cent to be finally classified elipeptic. The result of such a scheme would be the rejection by each E.E.G. team of one or two men per week or a total of about 1,000 trainees per annum. The view is held that in the present circumstances the practical results would not make such an enterprise worth while.

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APPENDIX : CASE REPORTS

Case 2 : *Susceptibility to oxygen lack (19,000 feet)*.—A Flight Engineer, aged 24, with 23 operational hours, felt a little queer and drowsy at 15,000 feet and became unconscious at 16,000 feet. He was receiving an adequate oxygen supply, but had not been over 14,000 feet before. Afterwards he had a sore ear due to the aircraft descending while he was unconscious. He had had no previous faints or fits, and his past record was good. No physical abnormality was found except that his blood pressure was 150/85, and he had a white count of 57,000 with a normal differential. He was considered psychiatrically normal. The E.E.G. was normal. At the R.A.F. Institute of Aviation Medicine he was taken to 15,000 feet and removed from oxygen. After 5 minutes he was very cyanosed and had considerable muscular twitching in the limbs. After 10 minutes he became faint, his pulse rose from 80 to 96, oxygen was restored and the twitching slowly subsided. Anoxia meter readings on another occasion showed that at 15,000 feet his blood oxygen saturation was considerably lower than the normal average. It was considered that the oxygen supply in the aircraft must have been faulty, but that the patient was unusually sensitive to oxygen lack. No spectroscopic abnormalities were found in his blood to account for this sensitivity.

Case 7 : *Brief epileptic attacks in a fighter pilot*.—An experienced commissioned pilot, aged 24, lost consciousness four times while flying a Spitfire. (i) At 11,000 feet he suddenly felt dizzy and light-headed, and was confused for a few moments. He thought this was due to oxygen and then had a similar brief attack. After this all was well. (ii) Six months later, at 3,000 feet, he started to do a roll. The next he knew the plane was diving towards the sea and he managed to pull out a few feet above the water, blacking himself out in doing so. He thinks he was ' out ' for 10 to 15 seconds. (iii) Three months later he was flying straight and level at 1,500 feet and then found himself at 5,000 feet. The plane was trimmed to climb and he thinks he was unconscious for 3½ to 4 minutes. He had no warning or sensation of an attack, but just knows that he had climbed 3,500 feet without being aware of it. (iv) Next day, at 300 feet under low clouds, trimmed nose high, he again found himself at 5,000 feet without being able to account for how he arrived there. He judged he was ' out ' for five minutes. He then landed and for the first time reported the attacks.

There were no symptoms between the brief periods of unconsciousness. His past and family histories were normal and full clinical examination was normal. The E.E.G. was quite abnormal. It showed rhythmic 9-a-second waves in outbursts in the frontal lobe ; rhythmic 6-a-second waves in outbursts in the parietal lobe ; and outbursts of irregular fast activity which on one occasion developed into rhythmic monophasic waves of 9 a second. It was thought that these changes represented a constitutional type of abnormality, almost certainly epileptic.

Case 8 : *Susceptibility to oxygen lack (12,000 feet)*.—An air gunner with 120 total and 38 operational hours, felt dizzy and faint at 12,000 feet sitting in his turret on the way to Berlin. He was found in a semi-conscious condition, recovered five minutes after having been given oxygen on the rest couch, but was slightly confused for 45 minutes afterwards. He was wearing a well-fitting mask at the time, but his economiser was found to be defective and no oxygen had reached him even with the supply turned to 30,000 feet. He remained perfectly well after this, no psychiatric cause was found, his past and family history were good, he denied fits or faints and he was keen to return to operational flying. Physical examination showed no defect and he was taken to 20,000 feet in a decompression chamber without oxygen satisfactorily. The E.E.G. was normal.

Case 15 : *Hysterical attack in a timid pilot under training*.—An L.A.C., pilot u/t, aged 25, with only 3½ hours' flying in Tiger Moths at a Grading E.F.T.S., had a syncopal ' attack ' while flying. At 2,500 feet when flying straight and level the machine went into a steep turn, the pupil did not correct and was found slumped down in the cockpit unconscious. The instructor landed in a few minutes, lifted the pupil still unconscious out of the aircraft. He came round on the way to the flight hut and was pale, breathless and shaking, with a rapid pulse. He had been a farm worker who had always lived on his farm, had not played games and had always been very careful of his health. When interviewed he said that when flying he got a pain in his chest, became breathless and felt literally like a fish out of water. He also got a pain in the left testicle—he had had a successful operation for varicocele sometime previously. These symptoms became worse each time he went up and culminated in trembling and palpitation, ending in the attack of amnesia. Since starting flying he had become more anxious, particularly about his health, had lost his appetite, became sleepless, and had nightmares that he was killing his instructor. He said " flying is not so simple as I had thought " and " it is taking a lot out of me," and ultimately admitted intense fear. He felt he did not want to go on if it was going to injure his health.

Case 17 : *Repeated amnesic attacks due to panic.*—A pilot, aged 22, had flown 340 hours and began operating in Bostons, and was sent for an E.E.G. with a diagnosis of epilepsy. On his *first* sortie he crash-landed his aircraft very badly on a small emergency landing ground, although the weather was clear and as he was in radio-communication he could have made base easily. His behaviour was inexplicable, but he had an amnesia for the whole episode. On his *second* he suddenly broke formation over the target. He side-slipped and would have hit his leader had the other aircraft not taken violent evasive action. He then dropped his bombs at random and made for home alone, in daylight, before the squadron. He was lucky to make base, but did not remember the episode. On his *third* sortie going out to the target he made a series of incredibly foolish technical mistakes, among which was keeping his engines on full boost so that they overheated and eventually caught fire. He, therefore, turned for home, jettisoned his bombs, but left his bomb doors open all the way back, made the coast and made a forced landing in the first field he saw without any selection or preparation, although he could have landed at one of the South Coast stations. He made the crash landing with his flaps up and his wheels down. He had an amnesia for all this. He was sent for an E.E.G. with a diagnosis of epilepsy.

On examination. Physical examination, including the E.E.G., was normal. After a few minutes' questioning it transpired that he was quite terrified on operations, was sure he would kill himself and his crew, and felt he could not go on. He admitted he had lost his head on each occasion, and was able with persuasion to give an account of what had taken place. On each occasion he had an uncontrollable urge to make for England, and as soon as he had done so to land at the earliest possible moment. He described how his increasing fear became so intense that in his terror he was confused and quite unable to think coherently or to act in a rational and ordered manner. His flying discipline broke down completely and gave way to blind panic. He had always been a timid unstable man, who had panicked at examinations and who should never have been accepted as a pilot.

Case 23 : An air gunner, aged 20, was making his first operational sortie, the target being Berlin. Over the target he was heard to go on and on firing his guns, and on being questioned over the intercomm. gave no reply. He was found unconscious and ' struggling ' in the turret, and was carried to the rest couch. He did not regain consciousness for 20 minutes. The attack of unconsciousness took place at 15,000 feet, and the subject was on oxygen, the apparatus being found satisfactory. There was no history of fits or faints in the patient or his family, and a psychiatrist who saw him shortly afterwards did not think the attack hysterical. The E.E.G. was quite abnormal. There were occasional waves of 3, 6 and 7 a second in all leads. They were widely distributed and represented a constitutional abnormality which may well be related to epilepsy. Decompression to 25,000 feet for 3 minutes resulted in involuntary twitching of the hands, but 15 minutes at 15,000 feet without oxygen were without effect.

Case 39 : *Unconsciousness caused by fear in a timid air gunner.*—A sergeant air gunner, aged 22, had flown 60 hours and started operations in Lancasters. His first two operational trips were to Duisberg and Berlin. Things were ' lively over the target ' and the activity, including sights of aircraft being coned, took his breath away. He slept badly and thought about it all a great deal and the next day was preoccupied with fear. Before the next trip to Berlin he had a headache and felt sick, he reported to the medical officer but was sent on the raid. Take-off was postponed for two hours, which upset him still further. After half-an-hour in the air, at 5,000 feet, he was sitting in the turret and felt hot and ill, sweat was pouring off his face and he was trembling all over. He felt dizzy and faint, told the pilot he was not feeling too good, remembers the reply of ' O.K.' and then remembers finding himself on the rest couch with two of the crew giving him oxygen. When he came round he was unable to remember 45 minutes, but he said he was dizzy, things seemed hazy, and he was still hot and sweating, but was better when they landed at base three-quarters-of-an-hour afterwards. He was told that he had failed to reply to further questions and was found unconscious. He confessed that operations had caused him intense fear, that his experiences on his first Berlin raid had affected him greatly, and that heavy casualties on the station had contributed. He was sleeping badly, had a poor appetite, felt depressed, wretched and run down, and had headaches. He had always been an anxious worrier, easily depressed, and previously was a professional dance-band drummer. His father is an established neurotic and was so anxious about the patient that he 'phoned him each day to know if he had been on ops. His mother is ' highly strung ' and worries more than the patient.

On examination.—His asthenic, colourless appearance bespoke his peacetime vocation, but he was also anxious, depressed and restless, picking his nails. He had a tremor of the fingers but otherwise the examination, including E.E.G., was normal.

Case 42 : *Hysterical amnesia in an experienced pilot.*—A Polish pilot officer with 1,000 flying hours was flying a Spitfire on his first sweep at 22,000 feet. The flight commander reported " over France he came into collision with the plane next to him, causing substantial damage to it. He then turned east and went in the opposite direction to the flight. When called on the radio he did not answer, so I followed him and succeeded in catching him not far from the Belgian frontier after 30 miles. I passed him and he joined me. We came home and landed. He flew satisfactorily in formation." A few days previously he had had a collision in flying with no amnesia. The patient remembered nothing in the 10 minutes between the collision and seeing his flight commander. He had had no fits or faints, and except that he tended to formate too closely his conduct had been satisfactory. Because of language difficulty his past history was not obtained in detail. He said the amnesia was due to oxygen failure, and although this cannot be excluded the technical reports did not support it. All examinations, including E.E.G., were normal. Hypnosis was not used, but the patient admitted to great fear and tension on his first operational trip. It is thought he collided through an error of judgment, because of his fear, panicked and then had an hysterical amnesia for his lapse.

Case 48 : *A faint associated with severe aural pain.*—A sergeant navigator with 600 hours' flying had never had any previous trouble with ears or sinuses. He had a cold and developed acute pain in the ears while diving at high speed. The pain was excruciating, and he felt sick and fainted, slumping forward on to his table. He came round in about 2 to 3 minutes when the plane was level. He still had severe pain in the ears. Eustachian insufflation was carried out a week after this episode, but air entry was unsatisfactory on both sides. In all other respects he was normal, physically and mentally, and his past record was excellent. In particular his cardiovascular system was normal. Three weeks later descent in a chamber from 15,000 feet at 7,000 feet per minute produced no symptoms.

Case 54 : *Susceptibility to oxygen lack* (*13,000 feet*).—An air gunner, aged 22, with 50 operational hours, felt confused and sick on the way to Germany. This increased and he did not reply over the intercomm. at 13,000 feet, but fell out of the turret when the doors were opened and was found to be stuporose and unable to walk. He was wearing a mask, but through an error of the pilot he had received no oxygen. Although the rest of the crew also had no oxygen they were unaffected. He recovered with oxygen, but his behaviour is not recorded and he had a bad frontal headache and nausea afterwards. He was very fatigued at the time, having operated on two of the preceding three nights and having spent the whole of the last on a railway station, so that it was his fourth night without sleep. He had previously been to 16,000 feet without oxygen with no ill effects. On examination, the only abnormality was a high blood pressure, the systolic being consistently 150, and diastolic 92 to 100. The E.E.G. was normal. He went back to operations and did several trips over the Alps on oxygen without symptoms.

Case 58 : *Susceptibility to oxygen lack* (*16,000 feet*).—A flight sergeant pilot, aged 24, with 500 hours' total and 100 operational, was going to Bremen on the thirteenth sortie of a tour which had contained some hazardous experiences. He thought he was getting no oxygen for he could not hear, feel or taste it, and at 16,000 feet he fell forward over the controls, and the navigator found him stuporose. The wireless operator flew the aircraft to 6,000 feet for 10 minutes and then the patient took over, brought it home and made a good landing. The rear gunner had become unconscious in similar circumstances the previous night, and it transpired that there was some suspicion that both he and the patient had been subjected to relative anoxia due to inadequate flow imposed by technical faults. No physical or psychiatric abnormality was found and he was anxious to return to operations, although he preferred day bombing to night, and was probably more affected by some very unpleasant experiences on his tour than he was prepared to admit. His past history was satisfactory. He volunteered, however, that he had been breathing very rapidly after reaching 6,000 feet. Subsequently full investigation at the R.A.F. Institute of Aviation Medicine at 15,000 feet without oxygen and with strenuous hyperventilation failed to show any abnormality.

Case 62 : *Fear with conscious hyperventilation.*—An air gunner, aged 20, had done 40 operational hours in Wellingtons. He felt apprehensive and unwell the day before take-off for his seventh sortie. He thought he would try to go through with the trip, but after about two hours' flying, at 16,000 feet, he was sweating freely and said he was breathing rapidly. He had a pressing feeling in the chest, experienced air hunger, asked for more oxygen and a little later lost consciousness. A member of the crew tried to rouse him without success, the plane came down to 10,000 feet and he regained consciousness after 5 minutes. The oxygen supply was satisfactory. He had fainted twice on a railway station 4 months previously. Examinations, including decompression tests with and without oxygen, and E.E.G., were all normal.

Case 64 : *Unconsciousness caused by fear in a timid pilot.*—A sergeant pilot, aged 22, had done 7 operational sorties in Halifaxes. He vomited before beginning his eighth sortie, and after 20 minutes, at 1,500 feet, he began to sweat and felt faint. He had a feeling of unreality and his whole attention became so fixed upon his instruments that they irresistably absorbed all his interest. Then his eyesight became blurred, he felt drowsy and was aware that he was falling forwards over the control column, but he could not prevent himself from doing so, although he was aware that this was wrong, and wanted to shout to warn the others. The next thing he knew was the bomb aimer pulling him back from off the stick and taking control of the aircraft. In a few moments he pulled himself together and brought the plane safely back to base. When half-way along the runway and when his cockpit drill was complete, he again slumped over the control column in the same way as before, but as the brakes were already on the plane stopped. He then recovered and was able to leave the aircraft without help. He was seen immediately afterwards by the Medical Officer, who could find no evidence of any physical abnormality.

During his operational tour he had had a succession of unpleasant experiences.: On the second sortie the aircraft got out of control in very rough weather, for it stalled when climbing with a full bomb load of 6,000 pounds of H.E. and incendiaries and spun from 2,500 to 1,000 feet, but he just managed to correct it and level out at 300 feet. Structural damage to the aircraft was so great that it was later written off. He lost all desire to fly after this and on the fifth trip when he was shot up and came back from Munich on two good engines he was unable to jettison his bombs and lost height steadily until they were released over the sea. On three other occasions he had to change aircraft immediately before take-off because of mechanical failure. All this resulted in a train of symptoms and he became moody, was irritable and unsociable and fatigued, could not concentrate, and although he slept well, did not benefit by it. Two nights before the amnesic attack he had been somnambulant for the first time. He said " the job has been getting me down."

He had always been intense and obsessional and inclined to worry. He had previously been an art student, his work ' took a lot out of him ' and he had become haggard and had lost weight before joining the R.A.F. He was an only child, his father being eccentric, moody and unstable, but there was no personal or family history of fits or faints. All physical investigations, including the E.E.G., were negative.

Case 66 : *Fear causing an epileptic fit.*—An air gunner, aged 20, was on his tenth trip to Kiel an hour from base at 13,000 feet on oxygen, sitting beside the pilot. He felt tense, nervous and very afraid. His tongue was dry, he was sweating, had palpitations and then had a feeling of suffocation and could not get his breath. He then developed a pain in the chest ' over the heart ' of a gripping, cramp-like quality. The sweating increased, he began trembling violently and his hands would not stay still. The captain saw he was blue and the patient told him he did not feel so well. He then lost consciousness and recovered on the rest couch 25 minutes later. During this time he had ' a twitching type of convulsion mostly in the legs. He frothed at the mouth and dribbled saliva.' When the patient regained consciousness he felt tired and had a headache and the aircraft was returning to base. Ten minutes after landing the Medical Officer could find no abnormal physical signs.

The subject had experienced great fear in his previous trips, in one of which the aircraft was blown on to its back by a near miss, while in another they were caught in a cone of searchlights. He vomited all night after these episodes. When flak or searchlights came close it was his habit to cover his eyes with his hands and he felt so acutely afraid that he used to bury his head in his knees if he were alone.

Previous history.—When the engine cut and the aircraft suddenly dived during air firing practice in a battle, he had previously had a similar pain in the chest, and had fallen to the floor unconscious for five minutes. He told no one about this. He had had similar attacks ever since childhood. They occurred every 2 to 3 months, from 12 to 17 years of age. They always followed a fright, for instance, when a train he was in nearly collided with another, when a train whistle went off near him, and when flogged at school. They always began with gradually increasing pain in the chest, he fell down and hurt himself, but had never been incontinent. When excited he sometimes got the pain without unconsciousness. He worked in a munitions factory before enlistment, and had been a quiet, solitary individual who lacked aggression. His mother also had attacks in which she suddenly started up from her chair, fell to the ground, had clonic movements, and went blue. His 12 siblings had no attacks.

Investigations.—Full clinical examination was normal and the E.E.G. did not show any epileptic disturbance. Executive reports showed him a keen and reliable gunner, and his attitude to his duty and to his disability was above reproach.

Questioning under pentothal narcosis recovered little of note, but it is important that the amnesia was not penetrated.

Decompression in a chamber gave interesting results. He was taken to 15,000 feet with and without oxygen. When breathing oxygen from a mask his respiration rate increased spontaneously from 14 to 40 a minute during 15 minutes at 15,000 feet. It remained at this level until he was asked to start 2 minutes' voluntary hyperventilation, when it reached 52 a minute. During this time the pulse rate rose from 102 resting to 120 per minute. Although asked repeatedly to stop deep breathing he did not, and appeared unconscious of doing so. Ventilation continued at about 50 a minute for 10 minutes. After 8 minutes he complained of pain in the chest, similar to that in his attacks. A sample of venous blood was taken but when the subject saw the syringe the respiration rate rose from 44 per minute to over 100 a minute for about 30 seconds. After a further minute his legs began to twitch. He was taken off oxygen, breathed a sample into a Douglas bag and the experiment was terminated. The respiration had remained at 48 without the mask. The patient had been unduly apprehensive throughout in spite of explanation, and said that towards the end of the experiment he had felt dazed and dizzy and had a pain in the chest, just as he did before the attack in the aircraft. There was no evidence of tetany. Results supplied by S/Ldr. Goldie were as follows : Anoxia meter readings showed a normal fall in blood oxygen saturation to 85 per cent. on air at 10,000 feet. At 15,000 feet at rest on oxygen, during forced and during spontaneous hyperventilation the saturation remained at a normal level (92 to 95 per cent.) The blood CO_2 content at ground level was 53·2 volumes per cent, and at height during spontaneous overbreathing it was 47·4 volumes per cent, a fall of nearly 6 volumes per cent. The CO_2 output was 358 ccs. per minute at N.T.P., and the ventilation rate at 15,000 feet was 25 litres per minute B.T.P. (about five times the average normal), his expired air containing 3·22 per cent CO_2 and 17·7 oxygen.

Case 67 : *Impairment of consciousness of cardiovascular origin.*—A Flying Officer Instructor with 1,400 flying hours, of which 100 had been on operations on Spitfires, had begun for 10 months to experience attacks in the air in which he suddenly felt dizzy, weak and confused, his vision became blurred, and he felt hot and sweated. He would open the window to put his head out and soon be all right. He had never actually let the plane get out of control, and did not report sick till he had had three. Such an attack had occurred two years previously, and he had had four similar turns on the ground. In one he felt faint in a crowded bar and went out and sat on the steps. Another occurred after a dentist had been cleaning his teeth without inflicting pain. On rising from the chair he felt faint. In all these attacks he first felt hot and giddy and ' swimming,' then weak, was said to go white, sweated and then felt cold. He did not actually lose consciousness in these attacks. His past history and family background were above reproach.

On examination.—There was no evidence of neurosis and physical examination was satisfactory, except that to exercise his cardiovascular tolerance was poor and his blood pressure was persistently around 140/75. At the R.A.F. Institute of Aviation Medicine his resistance to centrifugal force was below average. Decompression to 10,000 and 20,000 feet without oxygen on two occasions showed no abnormal responses. The Consultant in Medicine thought that his cardiovascular efficiency was poor, but it improved after a course of graduated exercises with games, followed by leave. It was considered that his attacks were due to lowered cardiovascular efficiency resulting from a lowered standard of health. He was returned to full flying and has been well for six months.

Case 69 : *Confusion complicating aural vertigo.*—A sergeant pilot had flown 270 hours under training, and has had six attacks of vertigo while flying. In these he has a sudden sensation that he is falling backwards and to the left while flying straight and level. He feels giddy and has to concentrate on his instruments to make sure of his position. He has to concentrate because of a feeling of confusion which he calls a " semi-blackout " in which he " nearly passes out," everything goes dark for a moment, but he does not lose consciousness. Three weeks before the interview, while flying an Oxford at 700 feet, he had the usual sudden onset of rotation backwards and to the left, and had to concentrate on the instruments. Even so he lost 500 feet, having gone into a steep dive to the left. He had similar attacks on the ground before entry in which he suddenly had vertigo, objects went round, he had to support himself and thought he might lose consciousness. The attacks were sufficiently severe and frequent for him to declare them on entry. Examination was normal, except that there was symmetrical slight deafness of a middle ear type. There was no inco-ordination, ataxia, Rombergism or nystagmus. As is usual, he was normal between the attacks.

Case 72 : *Hyperventilation syndrome without admitted fear.*—A West Indian sergeant pilot, aged 25, who had flown 50 operational hours in Spitfires, reported sick because he had had a series of attacks while flying (the attacks were all the same), and began about 15 minutes after take-off upon a convoy patrol or a sweep, at about 1,000 feet straight and level, with dizziness, a feeling of weakness, and then a fainting, confused sensation. His vision then went misty and he had tingling of the extremities. He had to turn back to base and the symptoms would subside on landing. He said he was perfectly happy flying a Spitfire over the sea, and that fear was not present and he never lost consciousness, although the symptoms lasted for up to 10 to 15 minutes. There was no carpo-pedal spasm. He had discovered that the attacks were associated with wearing a mask, and that when he did so his breathing was rapid and shallow, like panting. He had come to associate the symptoms with this, and as his breathing was normal without a mask when not using the microphone he kept the mask on his chin.

The sergeant had a good past and family history and an excellent service record ; he seemed well adjusted to his duties and very keen to continue on operations, saying that even if the attacks persisted, so long as he knew they were not serious he was quite prepared to carry on. Physical examination, including E.E.G., showed no abnormality. Two minutes quiet overbreathing produced vertigo, a light-headed feeling, blurring of vision and tingling of the fingers, and the subject volunteered that the symptoms were the same as he experienced in the aircraft. He returned to flying, was subsequently posted with his squadron, but was finally removed with a diagnosis of anxiety state.

Case 74 : *Unconsciousness complicating a fear state at high altitude.*—A sergeant bomb aimer who had flown 200 hours, which included three operational trips, was an unusually anxious and timid man, apt to become depressed and considered to be severely predisposed to neurosis. His third sortie was abandoned because of icing and low visibility, but over base his aircraft collided with another and in the resulting crash the pilot was killed, and the navigator air-gunner injured, but the patient only had bruises. The crash, and particularly the pilot's death, worried him greatly, and next day he felt tired and sick and did not sleep the next night. He was given three week's sick leave, but was unable to occupy himself, for he 'just wanted to stay around,' and when he started flying again was continually afraid of a collision and was terrified of flying at night or in cloud.

Two months after the collision, when flying in a Stirling in a day cross country at 17,000 feet in the front turret, using oxygen, he felt very nervous, had a headache, was sweating and his hands were 'freezing on to everything.' He then found himself at 10,000 feet on the bomb aimer's bed to which he had been carried, receiving attention, and was told that he had switched on the intercomm., had left it on and was found unconscious. No convulsive movements were seen, he did not hurt himself or bite his tongue, but he had passed urine during the attack, which lasted for 15 to 20 minutes, but his bladder was very full before it.

On questioning afterwards he admitted great fear, " I was trying to map-read, but all the time I gripped the pad tightly, hardly daring to look down to earth. When ice coated the outside of the turret I was cold and very unhappy, I felt panicky." An attempt was made by Wing Commander J. H. Hunt to obtain further information under pentothal about the period of amnesia, but although the patient co-operated well and gave a candid account of his fear and his wretched state before and after the attack, he was unable to recover any of the period of amnesia, and he did not remember having been incontinent. Physical examination, including electro-encephalography, was quite normal.

Case 81 : *Fear with tetany.*—A pilot u/t, aged 20, was having difficulty with instrument flying at night for he did not like it, and had to concentrate on the instruments constantly, until his 'nerves would go to bits.' He has had five attacks while flying, all after 2 to 3 hours of instrument flying, in which his arms first feel stiff, and his hands become stuck to the controls as if he were held from the elbows down. He cannot let go, as his hands will not relax, his movements become more difficult, the instruments move about and go blurred, so that he cannot read them, and he calls for help. He is unaware of any change in respiration. In the last attack he slumped in the seat as if exhausted, the Wellington stalled, and the bomb aimer, in wrenching his hands off the controls to take over, found that the pilot's hands were stiff. The patient later recovered and landed the aircraft. The attacks never occurred in day flying and he had never fainted previously. When examined he had an anxiety state with depression, and was having nightmares about night flying. Physical examination was normal, but after 4 minutes' moderate hyperventilation tetany appeared and Chvostek's sign was positive.

Case 88 : *Epileptic attacks in an air-gunner.*—An air-gunner, aged 21, with 75 flying hours, was stationed in the mid-upper turret of a Lancaster on an Operational Training Unit practice flight at 5,000 feet, without oxygen. He did not answer over the intercomm. twice and was found motionless in the turret. He did not respond to questioning, was helped out, and then professed himself quite well. It was estimated that he had not answered for 15 minutes, but no more information is available. A few days later, at 20,000 feet, again on a practice flight, wearing a type G mask on full oxygen, he suddenly felt himself floating away as if he were outside the aircraft supported by air. He called the captain, he thinks unintelligibly, and was found rigid in his turret. He was unconscious for 15 to 20 minutes, and was next aware of being given tea. For 18 months he had had attacks of forgetfulness on the ground, when his mind would suddenly go blank. Characteristically, he would walk straight past a friend with a vacant expression, turning back in embarrassment when his mind became clear, or would go to post a letter and walk past the post box without knowing he had done so. He had had no fits or faints before, but had been an unstable, nervous boy. His mother had fits in which she suddenly fell to the ground for a few moments. The only physical abnormality was seen in the E.E.G. which, among other abnormal features of a constitutional type, showed a larval epileptic attack and so confirmed the diagnosis of epilepsy.

Case 100 : A Flying Officer Instructor at Elementary Flying Training School, with 1,000 hours flying in under 2 years, had been showing evidence of increasing fatigue for 9 months. This began by his feeling mentally and physically tired and by his sleeping while in the mess. He would be worn out at the end of an instructional flight, and felt so tired that he was finding it quite difficult to walk to the flight hut. The symptoms became worse and he was seen to be losing weight, looking haggard and very tired. Five months previously he was given 8 days' leave with great benefit. He went back to his duties instructing for 5 hours every day, and his symptoms rapidly returned and became worse. After three months he felt quite exhausted 'mentally and physically.' He said he was "worn out." He was anxious, emotional, irritable, sleepless and having nightmares. He had lost two stones in weight. He began to find that his vision became blurred, and things went grey as he was doing a 'flip off the top.' Each time he did this it became worse, until he was actually blacking out but not losing consciousness. He had previously performed this manoeuvre hundreds of times with ease. He did not report this, but happened to be taken on a test flight, and while repeating the manoeuvre with the Chief Flying Instructor he lost consciousness, the aircraft stalled and went into a spin which he corrected. He was taken off flying. Shortly afterwards, at home, he caused himself pain by knocking his knee against a table and fainted for the first time in his life. His wife witnessed the attack, which had all the characteristics of syncope as he was white, pulseless, sweating and cold. The attack lasted for a few seconds. He was removed from flying and sent on a course of ground instruction, but found himself unable to stand the pace, and in consequence had three short periods of hysterical amnesia. His past history showed him to have been conscientious and easily worried. One of his brothers is similar, the other excitable and unstable. There was no family history of faints or fits.

CHAPTER XXI

THE PSYCHOLOGICAL ASPECTS OF AIRSICKNESS

by

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Introduction

The object of this investigation was to determine to what extent and in what ways psychological disorder might be a factor responsible for the cessation of flying duties owing to airsickness in the Royal Air Force.

1. Material

One-hundred-and-twenty men were personally examined by the two investigators, each independently interviewing 60 cases. Owing to the present disposition of training units it was not practicable to obtain a representative sample of airsick eliminees from all stages of training. The cases were drawn from :

(a) Grading Schools, Radio Schools, Air Gunnery Schools, the Air Navigation and Bombing School, and Advanced Flying Units (Pilot and Observer) within convenient travelling range.

(b) The Operational Training Units, Finishing Schools and Heavy Conversion Units of Bomber Command.

The geographical limits referred to under (a) happened to include all the Observer Advanced Flying Units, but excluded 8 out of a total of 29 Pilot Advanced Flying Units. From these 8 units, however, there was only one case of suspension for airsickness during the period under review. The sample, therefore, was fairly representative of aircrew personnel under training in this country. It must be remembered, however, that the early and intermediate stages of training for pilots, navigators and air bombers are conducted overseas. Instructions for reference of cases were issued by the P.M.Os. of the commands concerned. These were that during a specified period all men who were to be withdrawn from flying training on account of airsickness should be referred to the investigators as soon as this decision had been reached. The cases were to include all aircrew who had not yet received their brevets, and who would consequently be disposed of by the executive, as well as all others who were to be referred as soon as a request had been made for the necessary medical board. The man was to bring a sealed envelope containing a report by the unit medical officer, including a record of airsickness and any treatment given for it at that station ; any previous record of airsickness contained in Form 48 or other document ; and a report written by the commanding officer upon the man's general efficiency and behaviour, referring especially to his attitude to his flying duties.

2. Method

Each individual was interviewed privately for one hour by one or other of the investigators. Before being questioned he was told that the purpose of the enquiry was to obtain information about airsickness which might be of value to others, and that we were especially interested in any relationship which might exist between the kind of airsickness experienced and the kind of man who experienced the airsickness. The man was then informed that no report would be sent to the unit or medical board, the information received being used for research purposes only without reference to his name. It was assumed for purposes of the interview that the man's flying career had probably ended. The history was then taken under the following headings :—

(*a*) History of airsickness

(i) The symptoms usually experienced when the man was airsick, including the first symptom, and subsequent course, and the frequency and degree of incapacity when airsickness occurred. In addition to nausea and vomiting, the following symptoms were enquired for if the subject did not mention them spontaneously—headache, giddiness and mental slowness.

(ii) The time after take-off or after the occurrence of unfavourable conditions at which the first symptoms of airsickness were usually experienced.

(iii) The nature and duration of any symptoms experienced after landing.

(iv) A record of each phase of the man's flying experience (pre-flying training, Grading School, Air Observer School, Advanced Flying Unit, Operational Training Unit) including the number of hours and trips flown; the type of aircraft; the percentage of trips on which he vomited; the percentage of trips on which he felt quite comfortable; any tendency to a diminishing liability to airsickness on the course; and whether, on each phase of his flying training, the man had reported airsickness to the medical officer (either of his own accord or because he was ordered or advised to do so) and if he did not report it, why not. A note of any treatment the man had received for airsickness and of the effects of such treatment.

(v) Whether any of the following causes had in the man's experience contributed to the airsickness:—

Rough weather.
Aerobatics, evasive action or other violent movements.
The type of aircraft.
His position in the aircraft.
The duration of the flight.
The temperature in the aircraft.
The smell in the aircraft.
The effect of other occupants of the aircraft vomiting.
Anxiety or apprehension.
Any other causes.

(b) History of motion sickness

Full details were taken of symptoms caused by the motion of sea, car, 'bus, train, tram, swings, roundabouts, at any time in life, including adaptation with age.

(c) Psychiatric history and assessment of predisposition to psychological disorder on a 4-point scale

This was obtained and recorded by methods already described in Chapter X (Symonds and Williams, 1944). In the course of the interview evidence was collected for deciding whether or not the man was at the time suffering from a neurosis.

(d) Attitude towards flying

This part of the history comprised the man's motives for volunteering for flying; his psychological reactions to flying experience and especially to any mishaps, and to his airsickness; his reaction to the prospect of being grounded; and his own wishes or plans for further employment in or out of the service, if grounded.

(e) Assessment by commanding officer

A copy of the Commanding Officer's report was filed with each case record.

3. Analysis of material

TABLE I

Distribution in air crew categories of the 120 subjects suspended for airsickness.

Category	Percentage
Navigator	35·8
Air gunner	25·0
Wireless operator	21·6
Engineer	7·5
Air bomber	6·7
Pilot	2·5
P.N.B.	0·8

The order in this table probably represents the relative airsickness suspension rates among aircrew under training in this country since the subjects of this enquiry were not otherwise selected. The extraordinarily low figure for pilots deserves comment. The three pilots who were included in the 120 cases were in fact all suffering from a neurosis at the time of interview so that there was no instance of a pilot suspended for uncomplicated airsickness in the present series. This important fact will be discussed later.

(*a*) Flying hours

The average hours flown before suspension was 116, but 37 of the subjects had completed less than 50 hours, 13 had flown more than 200 hours and 3 more than 300 hours, while 5 had been on operations, two having completed an operational tour.

(*b*) Symptomatology

It is necessary to give some account of the symptoms recorded because it has been argued that certain variations in the symptom pattern of airsickness may themselves indicate a psychological basis.

All the subjects experienced *nausea,* with its accompanying symptoms of autonomic disturbance. The most common story was of the rapid onset of sweating with a *feeling of warmth or of cold* associated with nausea and leading to vomiting. In all except six cases it was the rule for vomiting, when it occurred, to be repeated.

There were other associated symptoms, of which the most notable was *headache,* which was mentioned in half the cases. It usually appeared before the vomiting and persisted after it had ceased, often until after landing. Occasionally it followed the vomiting and at times replaced it. *Dizziness* was a frequent complaint but cross-examination disclosed sensations which could be accepted as vertiginous in only about a quarter of the cases. Less frequently, a sensation of *slowing of mental processes* was experienced.

In 100 of the 120, when symptoms occurred they *persisted continuously* during the trip, but in the other 20 though usually persisting to the end of the trip, they were *intermittent.* In these cases there was increasing nausea leading to vomiting, total or almost total relief for a few minutes, and then a recurrence of the symptoms, each bout having the same general character as the preceding, except that vomiting was ultimately replaced by retching. In every instance except two the symptoms persisted continuously or intermittently right up to the time of landing. One of the men whose symptoms would abate had a disabling neurosis with mild airsickness, and in the other nausea and other symptoms would always persist to the end of the trip unless he vomited. This means that in the 120 men suspended for airsickness there was virtually no evidence of *adaptation* to the motion of the aircraft during the trip once airsickness had started.

All the subjects except two complained of *persistence of symptoms after landing* which varied in severity and in duration. The following table gives an impression of the maximum length of time for which symptoms were experienced on the ground :—

TABLE II

Duration of symptoms	No.	Percentage
No symptoms at all	2	1·7
Lasting an hour or less	38	32
Lasting from 1 to 6 hours ..	42	35
Lasting until after a night's sleep	14	12
Lasting for a day or more ..	24	20

The symptoms ranged from persistent nausea, headache, giddiness, lassitude, weakness and a faint feeling, to complaint of slight anorexia or abdominal discomfort with hunger. There was a close direct relationship between the severity of the symptoms in the air and their severity and persistence on landing. A few men had symptoms for only a few minutes after landing, others were soon relieved after a meal, while many of the others with more persistent symptoms found that lying down and resting was most helpful. A common story was that of gradually decreasing symptoms until going to bed, with complete freedom next morning. The group of subjects who had had symptoms persisting for more than a day were interesting. Such unusual persistence often followed a particularly distressing trip but there were other cases in which the cumulative effect of repeated flights was mainly responsible. Thus several men said that their symptoms after landing were more intense and persistent after two trips in one day than after a single trip, others described the cumulative effect of a busy period of flying. The following is an example :—

Case 88 : A sergeant, aged 30, a flight engineer with 83 hours flying, was referred from an H.C.U., his symptoms being giddiness, which was increased when sitting in the 2nd pilot's seat by turning his head to look at the instrument panel, nausea, sweating and repeated vomiting. Towards the end of a long trip he came ataxic in his movements and his thought was slowed. He had vomited on 90 per cent of his trips. His spontaneous account of his symptoms after landing was as follows : "On getting out of the aircraft I am very giddy and the worst feature is the uncertainty of knowing where my feet are going. My mind is so that if people are talking to me I have to think to get the gist of what they are saying. There is severe headache with an ache behind the eyes and soreness on the top of my head if I comb my hair. I get some relief from this by lying down and taking aspirin. I have no appetite and am liable to be sick if I eat. My stomach feels on the work." The maximal duration of such symptoms he estimated at three to four days from the following experience : From the time he first started flying he had only once had more than 48 hours between flights. This was during a period of 7 days leave, and he did not feel really well until the fourth day. Up till that time he had felt persistently ill since his first flight. On returning from leave he did a 5-hour circuit and landing detail in very calm conditions and was quite comfortable. The next day he was on a similar detail under comparable conditions and was all right for 3 hours, after which he had airsickness for the remaining one-and-a-half hours, and took one-and-a-half hours to recover after landing. Next day, on a similar trip under rather less favourable conditions, it began after 1 hour and continued for the rest of the trip. From this time onwards he felt persistently ill (maximum interval between trips 48 hours). When seen 3 days after his last trip he felt well except for anorexia and an ache behind the eyes which he had previously noted as the last symptoms to disappear. He was a very stable man with no evidence of neurosis or neurotic predisposition and his morale was good. He liked flying and had shown notable persistence in carrying on with it. There was a history of his always vomiting on scenic railways and switchbacks since childhood ; he had not been on the sea, and was not sick in cars or trains.

Our observations have convinced us that there is no intensity or persistence of symptoms on the ground which is not compatible with airsickness uncomplicated by any other physical or psychological disorder.

The degree of *incapacity* resulting from the airsickness was judged from the man's own statements and from the executive reports. The incapacity did not, for purposes of assessment, include the period when the man was distracted by actually vomiting. In two-thirds of the cases the man had at some time in his flying career been so incapable in the air that he had been unable to attend to his duties. *Inefficiency* short of total incapacity was described by the man or his colleagues in nearly every case (94 per cent). It may, therefore, be assumed from this sample of cases that before a man is suspended for airsickness by present standards his disability has made him seriously inefficient in his duties.

The *frequency* with which airsickness is experienced can only be determined in retrospect and then as a rule only from the man's unsupported statement, for unfortunately no course to course record of airsickness is kept. It may well be that the man's story is inaccurate even when he is genuinely attempting to give a true account of his condition. The frequency varies in the course with weather conditions, and with the kind of exercise and the type of aircraft. A rough indication of the frequency of airsickness at the time of suspension is given by the following table :—

TABLE III

Frequency of airsickness at the time of suspension

Percentage of trips in which vomiting occurred on last course before suspension	Percentage of cases (Total 120)
0–24	6
25–49	7
50–74	21
75–99	43
100	24

This table shows that two-thirds of the suspended men vomited on the great majority of their later trips, and reference to the notes shows that in most instances symptoms were present on many of the trips in which vomiting did not occur. This comment upon the frequency of airsickness in a course leads to consideration of the degree of *adaptation during the course.* It has been shown that in aircrew suspended for airsickness, adaptation does not occur during a trip. In 20 (17 per cent) some adaptation to airsickness was recognised during at least one course of instruction in the man's flying career. By this it is meant that the occurrence of nausea or vomiting was less frequent at the end of the course than at the beginning. In the remaining 100 cases (83 per cent) the sickness continued throughout the course without variation except in relation to adverse conditions. *Adaptation during the flying career* was, of course, not met in any case, since it was failure of adaptation which led to the man's ultimate suspension. In several cases there was progressive failure of adaptation with increasing experience as in the following case :—

> Case 104 : A pilot officer, air gunner, aged 21, with 230 flying hours, was referred from an O.T.U. where he was instructing. His symptoms were continuous nausea and repeated vomiting throughout the trip. After a bad trip he took 24 hours to recover. The main factor was evasive action. With progressive experience he was more frequently affected, the time of onset was shorter, vomiting gave him less relief, incapacity was therefore greater, and the duration of symptoms after landing was longer. At his A.G.S. he vomited on a third of the trips (only those with evasive action) and at the O.T.U. on 20 per cent. He then went to a Lancaster squadron and did 23 operations, his tour being prematurely ended because of airsickness which only troubled him severely when there was evasive action. On his first 4 trips with an average pilot he vomited on 2 : in the next 17 with a pilot whose usual habit was to fly straight and level he vomited on 4 : on the last 2 trips with a pilot who weaved most of the time he vomited frequently and was disabled. After his tour he did two fighter affiliation details at an O.T.U. as instructor and vomited on both. He was, therefore, given 3 months' rest from flying, but on resuming, after 3 trips of straight and level flying without airsickness, he did 9 trips involving evasive action and was incapacitated on all, vomiting on 8. He was not improved by treatment. There was no history of motion sickness until after his increased liability to airsickness, when he found that the scenic railway upset him. There was no evidence of neurotic predisposition. His attitude towards flying as judged from the interview, and from the executive report was flawless. No reason could be discovered for his progressive failure of adaptation except that he had developed a conditioned response so that eventually " even the smell of a kite running up will give me that sick feeling, even when I'm passing one and not going to fly."

Special causes for the disability were sought, as has been described (Method, page 282). In some of the more severe cases, the man was invariably sick while airborne, vomiting occurred while the aircraft was flying straight and level in calm weather, and he said that he was always so sick that he did not know any factor which did, or could, make him worse. The aggravating factors most frequently incriminated were :—bumpy weather, in 82 per cent of cases ; evasive action, particularly during fighter affiliation exercises, and aerobatics of any sort, in 70 per cent ; and the length of time exposed to motion, that is unusually long trips, in 53 per cent. The following factors were also mentioned : the smell of the aircraft—petrol, coolant and hydraulic fluids ; warmth ; the type of aircraft ; the position in the aircraft, particularly of the rear gunner, navigator or wireless operator who may sit sideways, and the bomb aimer lying flat in the nose ; and apprehension either of danger or of failure to complete the task. One or more of the factors other than rough weather and violent manoeuvres were blamed by almost three-quarters of the subjects.

The *time of onset* of airsickness in a trip depends in most instances, of course, upon whether any of the special aggravating factors are present during the trip, and upon their intensity at the time. The usual interval after take-off at which symptoms commenced was 20 minutes to an hour. Those (12 per cent) who persistently noticed symptoms early, within 5 or 10 minutes of take-off, were nearly all men with severe, incapacitating airsickness and they all had a previous history of motion sickness, usually of exceptional degree. Symptoms may also occur, however, as a result of association without any motion, for two men who had been persistently airsick ultimately became mildly nauseated as soon as they entered the aircraft, and before it was airborne. In neither case was there any evidence of neurosis, neurotic predisposition or defective morale. This anticipatory reaction, though dependent upon factors which may be described as psychological, we regard not as a neurosis but as a conditioned response. It is, of course, well recognised as a complication of seasickness.

The men with a variable or late onset of nausea in the air were all sick in response to specific conditions, which have already been described. They remained well until the special cause, usually evasive action or bumpy conditions, operated.

(*c*) Psychiatric assessment

As already explained two questions were considered in every case—whether the man was suffering from a neurosis and whether he showed any predisposition to neurosis. In order to obtain as much consistency as possible in answering these two questions, criteria were discussed before the material was analysed and it was agreed that a neurosis should be defined as an illness characterised by the mental or bodily symptoms of an affective disorder—anxiety or depression ; hysteria ; or an obsessive compulsive neurosis. These symptoms might be independent of the airsickness, they might cause or contribute to it, or might develop as a result of the airsickness. Whatever part they might play in the total symptom picture they must constitute disability additional to airsickness in order to be called neurosis. Predisposition to neurosis was assessed as nil, slight, moderate or severe on the basis of previous studies (Symonds and Williams, 1944). This assessment was, of course, quite independent of the diagnosis of neurosis. Whether a man is suffering from a neurosis, airsickness or a broken leg one may enquire whether there is evidence from his past history of a neurotic constitution. The concept of the neurotic constitution used by us in this and previous reports closely resembles that admirably described by Slater (1943) with the important exception that we have given especial weight to factors which have been shown by Gillespie (1942) and others to indicate the probability of neurotic breakdown under the particular stress of flying duties. The assessment of severe predisposition is equivalent to a clinical impression of sufficient probability of breakdown to have justified rejection at entry by an Aviation Candidates Medical Board.

(*d*) Neurosis

Evidence of a neurosis was found in 9 subjects—7·5 per cent of the total. There were 6 men with an anxiety neurosis, 2 with hysteria, and 1 with anxiety and hysteria. In one of the cases of anxiety neurosis the symptoms though they had been ascribed by the Medical Officer to airsickness were in fact symptomatic of neurosis.

Case 37 : An L.A.C. pilot under training, aged 24, was referred from an E.F.T.S. with 42 flying hours. He had always been nervous of heights, had been under medical care for four months at the age of 15 on account of depression and feelings of unreality, with a subsequent liability to milder episodes of the same kind of illness, and up to the age of 18 had a phobia of eating in public places. His training began in the U.S.A., but he was failed after 7 hours probably because he was nervous. In this country he was given a second chance and passed through a Grading School. He was nervous of spinning but got over it. At his Elementary Flying Training School in South Africa after 3 hours' flying he became run down and depressed, was given sick leave and failed to finish the course, but returned to this country. Here he again commenced Elementary Flying Training School training, but in any new manoeuvre which tested his confidence developed severe anxiety with gripping in the stomach and nausea. These sensations he described as quite different from those of true airsickness which he had twice experienced in rough weather.

The distinction between true airsickness defined as a species of motion sickness and the visceral accompaniments of an anxiety state is, we believe, quite clear and will be considered further in the discussion.

In the other 8 cases there was evidence of neurotic disability in addition to true airsickness of some degree. In some of them the neurosis was judged to have contributed to the airsickness by weakening the capacity for adaptation to motion. The following case was the most striking example :—

Case 49 : A sergeant wireless operator/air gunner, aged 22, with 200 flying hours was referred from an Operational Training Unit with symptoms of nausea an hour after take-off continuing through the trip with recurrent vomiting. He felt ill for 3 hours after landing. He had never suffered from airsickness at any stage of his training, but shortly after joining his squadron was involved in a crash in which 4 of the crew were killed and he had a head injury with amnesia for 1 hour. On recovering his senses he helped to drag from the wreckage a badly injured comrade who afterwards died. Following this experience he continued flying but developed anxiety symptoms, and also experienced airsickness on every trip. There was no history of motion sickness or of neurotic predisposition. His morale was good.

In this case the development of an anxiety neurosis resulting from a severe psychological trauma led directly to a loss of adaptation to the motion of the aircraft with consequent disabling airsickness. In another instance (Case 84) an anxiety neurosis arising from domestic causes resulted in a considerable aggravation of a mild degree of airsickness and was further complicated by a hysterical reaction.

Case 84 : A flying officer, pilot, aged 24, with 1,225 hours, mostly as staff pilot, was referred from an Advanced Flying Unit, where he was under training. Until recently he had been quite comfortable on more than 75 per cent of flights, though he was airsick in usually rough weather and in aerobatics. After hearing that his mother in Canada, to whom he was very devoted, had cancer, he became worried and sleepless, and after this was nauseated on every trip with occasional vomiting. He tried to get a compassionate home posting and failed. He hoped to get invalided home for airsickness and had an exaggerated idea of his disability. In this case a slight liability to airsickness was aggravated by domestic anxiety, and provided the basis for a hysterical reaction. There was no evidence of neurotic predisposition. Morale was rated as indifferent.

There were three cases in which airsickness was associated with an anxiety neurosis arising from failure to achieve confidence in the air, and in each case the neurosis was considered to have aggravated the airsickness. The most characteristic example was the following.

Case 15 : An A.C.2 wireless operator, aged 19, with 5 hours' flying in the A.T.C. and 7 hours in the service, was referred from a Radio School. His symptoms were nausea, sweating and abdominal discomfort beginning half an hour after take-off, followed by headache and repeated vomiting, the symptoms persisting till he landed, and afterwards for an hour. He had vomited on every trip except one. There was a past history of motion sickness on 'buses, cars and trains up to the time of the interview. He admitted constant fear in the air, imagining all kinds of catastrophes and making plans for baling out. On the ground he counted the hours to his next trip, dreamed of flying and crashes, was easily startled and had become depressed and unsociable. At the interview he was tremulous, tense and pale. His father had a neurosis and he himself had always been timid, anxious, unaggressive and liable to depression. Predisposition to neurosis was assessed as severe. He confessed that any manoeuvre in the air which increased his fear accelerated the onset of airsickness. His parents had exerted pressure upon him to withdraw from flying duties, and his attitude had been influenced by this. Morale was assessed as indifferent.

In two cases symptoms which bore the imprint of true airsickness, with little vomiting, and probably little physical disability were complicated by the development of hysteria, probably motivated by the desire to evade flying duties. The following is an example :—

Case 101 : A sergeant pilot, aged 22, with 220 hours, was referred from an A.F.U. His symptoms were giddiness ("as if you had been spinning yourself around"), and nausea persisting throughout the trip with only occasional vomiting. Nausea and anorexia might persist for 3 hours after landing. He stated that he had been quite comfortable on about 25 per cent of trips. At the Advanced Flying Unit from which he was referred he had been nauseated on all of 10 trips but had not vomited. There was a history of motion sickness in cars and roundabouts. When 18 he had been under medical care because he was depressed and run down when working overtime and attending night school, and he was easily hurt if people said he was not doing his share. He had reported sick several times for dyspepsia which was investigated with negative results. During the interview he protested that he was not fit to fly—"Either cure my stomach or let me get out of the Service." The executive report recorded that he had been nervous in training (though the patient denied this). His Commanding Officer had formed the opinion that he was trying to evade flying duties. His behaviour during the interview was histrionic and the case was regarded as one of true airsickness of moderate degree with hysterical exaggeration. There was no evidence of neurotic predisposition. Morale was assessed as bad.

In the remaining case the neurosis developed after an infection and it was difficult to decide whether the physical or the psychological factor had been more important in increasing the liability to airsickness.

Case 63 : A sergeant W.Op./A.G., aged 26, with 60 hours' flying, was referred from an O.T.U. His symptoms were persistent nausea and headache with recurrent vomiting beginning after an hour and a half in the air, and continuing throughout the trip. Symptoms persisted for as long as 3 hours after landing. He vomited once at Wireless School, not at all at Air Gunnery School and once at Advanced Flying Unit, being nauseated without vomiting on about 20 per cent of trips. Then he was admitted to hospital with persistent fever, and subsequently had a succession of boils. On returning to duty he was easily fatigued, irritable, depressed and anxious, and on starting to fly again he vomited with severe incapacity on 60 per cent of trips. He reacted to this with a sense of inferiority and frustration which increased his anxiety. There was no evidence of neurotic predisposition or of motion sickness. His morale was good.

In none of the other 111 cases could any evidence be found of neurosis as we have defined it.

(*e*) Predisposition to neurosis

TABLE IV

Assessment of predisposition to neurosis

Grade of predisposition	No. of subjects			Percentage of total
	Observer 1	Observer 2	Total	
Severe	5	4	9	7·5
Moderate	8	7	15	12·5
Slight	14	13	27	22·5
Nil	33	36	69	57·5
Total	60	60	120	100·0

Thus 42·5 per cent of the subjects were thought to show some evidence of predisposition, and in 7·5 per cent it was considered sufficient to have warranted rejection at entry. The main value of these figures is that they can be compared with those obtained for other aircrew who were not eliminated for airsickness and who had been assessed in a similar way. It has been stated under Method, paragraph 2, that the standard of assessment conformed as closely as possible to that adopted in the *Harrogate Experiment* (Symonds and Williams, 1944) of which both the observers had intimate knowledge.

The results of that experiment are comparable in that :—

(i) The standards of assessment were as far as possible the same.

(ii) The subjects had all reached A.F.U. so that the average flying experience was much the same—about 120 hours.

(iii) The subjects differed medically from the subjects of the present investigation only in that they had not been suspended for air-sickness.

An important difference was that all the subjects of the *Harrogate Experiment* were pilots, who by natural selection were virtually excluded from this survey. A comparison of the results of these two enquiries, and of a similar enquiry into tour-expired pilots follows in Table V. This table shows that the number not considered in any way predisposed in the airsick group falls midway between that of the pilots before A.F.U. and after operations.

TABLE V

Assessment of predisposition to neurosis

Grade of predisposition	Percentage of total		
	Present airsick eliminees	Healthy pilots continuing flying	
		Before Advanced Flying Unit	After operations
Severe	7·5	2	0·6
Moderate	12·5	10	1·5
Slight	22·5	46	26·0
Nil	57·5	42	72·0
Total subjects	120	1,009	335

There is, however, a significant greater number of severely predisposed subjects in the present series of airsick eliminees than in the pilots continuing Advanced Flying Unit training. The likelihood of this difference being due to chance is less than 1 in 100 ($P < 0{\cdot}01 X^2 \text{-} = 87$). It will be profitable to examine the severely predisposed subjects in closer detail.

(*f*) Airsick subjects who were severely predisposed

Of the 9 severely predisposed subjects 3 were suffering from a neurosis at the time of examination. One of these (Case 37, page 288) was judged not to be suffering from true airsickness at all, and in the two others anxiety symptoms in the air, arising from fear of flying, were considered to have contributed in an important degree to the causation of true airsickness.

In 4 of the remaining severely predisposed it was considered that although there was no evidence of neurosis the neurotic predisposition had contributed to the disability. It did this in one or both of two ways, by lowering the threshold for airsickness (3 cases) and by weakening the man's capacity to endure airsickness (4 cases). Examples of the first mechanism are the following :—

Case 60 : A sergeant air gunner, aged 20, with 50 flying hours, was referred from a Conversion Unit. His symptoms were continuous and persistent nausea with occasional vomiting occurring on 50 per cent of trips at A.G.S. and O.T.U., and on all his 9 trips at the Conversion Unit. Symptoms persisted for 1 hour after landing. There was a history of motion sickness on trains and swings. Two near relatives had been under medical care for psychological illness : he had always been shy and timid, lacked aggressiveness, was over-concerned with his health, before examinations used to feel tense and nauseated so that he failed to do himself justice and had a special fear of heights. He volunteered for air crew hoping to be a pilot, because he felt it was the best job he could do in the war and that he might at last be a success in life. He thought he would be able to overcome his fear of heights, but found himself unable to attain any sense of security in the air and would feel nauseated with fear before entering the aircraft. Nevertheless, he carried on and did not report sick until ordered to do so by his captain at the Conversion Unit. He frankly admitted his fear of flying, but denied any fear of operations though admitting he had no wish to fight the enemy. Rather than do a ground job in the R.A.F. he preferred the hope of working in a coal mine, where he would, he thought, be making a more active contribution to the war effort. The impression he gave was of being straightforward and sincere. Morale was assessed as good, though the executive had judged it to be bad.

Case 116 : A Canadian sergeant air gunner, aged 21, with 75 flying hours, was referred from an O.T.U. His symptoms were nausea and recurrent vomiting continuing throughout the trip. At the B. and G.S. he vomited on all his 19 trips, was told to report sick, but subsequently concealed his sickness. At the O.T.U. he vomited on more than 75 per cent of the trips, and was nauseated on the others. The onset of nausea was usually 5 minutes after take-off, but on his last two trips occurred while going down the runway. He was ordered to report sick by his captain. After a single trip he recovered in 3 hours, but after flying on two or three consecutive days he felt limp and had no appetite for three days, and during this period would have waves of nausea, unrelated to food, time of day or other factors. There was a previous history of motion sickness in cars, trams and trains. His father was an unstable alcoholic who deserted the family, and he was over-attached to his mother. As a boy he always thought that he was physically inferior to others, and that he felt pain more easily so that he avoided fights and was bullied in consequence. He had obsessional tendencies which interfered with his efficiency. At the age of 18 when working in a factory he became fatigued and anxious, and had attacks in which he felt faint and sick, for which he was under medical care but not off work. During his illness he became fastidious about his food. If he ate food which he disliked he would immediately vomit, and the sight of distasteful food gave him nausea. This habit continued. He was in a reserved occupation, but volunteered for aircrew duties from excellent motives. He was not nervous in the air and did not want to be grounded. Neurotic predisposition was rated as severe, and was considered to have contributed to the airsickness in a specific way by lowering the threshold for nausea and vomiting. Morale was assessed as good.

An example of the second mechanism, where a man's psychologica immaturity, liability to depression, and lack of persistence handicapped him in his ability to endure is the following :—

Case 98 : A sergeant air gunner, aged 22, with 130 flying hours, was referred from a H.C.U. His symptoms were nausea with occasional vomiting whenever he was exposed to rough weather or evasive action. Following a bad trip, symptoms persisted for an hour after landing. At A.G.S. he was nauseated on 10 per cent of trips and vomited only once : at O.T.U. he vomited on 15 per cent of trips and was nauseated on another 25 per cent. At H.C.U. he vomited on 25 per cent and was nauseated on another 12 per cent. There was a history of motion sickness on long bus journeys and on swings. His father and brother were both liable to moods of depression. He had clerical jobs after school but eventually obtained a scholarship at a School of Dramatic Art and earned his living as an actor, but he lacked self-confidence and occasionally suffered from stage fright. He was liable to moods of depression in any uncongenial environment, and on one occasion had become sleepless, irritable and unsociable for a period of several days. After a mood of this kind he would usually become elated for a day or two. His motivation for joining an air crew was sound but after entering the Service he was homesick. At the interview he gave the impression of being narcissistic and immature, and it was considered that he was making the most of his symptoms, and that his keenness for flying was feigned. His morale, therefore, was rated as indifferent, though the executive reported it good.

Two examples of severely predisposed men remain. In these two cases there was no evidence of neurosis and the predisposition did not appear to have contributed either to the airsickness or the incapacity to endure it.

Case 1: A pilot officer navigator, aged 29, with 137 flying hours, was referred from an A.F.U. His symptoms were persistent and continuous nausea and headache with or without vomiting. He had vomited on more than 50 per cent of trips and had been free from symptoms on very few. After a bad trip symptoms persisted for the rest of the day. There was no history of motion sickness. His father was psychotic. He himself had never played any team games, his only interests being art and music ; he was scared of water and therefore did not learn to swim, he avoided fights, seldom left home, made few friends and was still a nail biter. He appeared to have made a commendable effort to persist despite his disability, and to be genuinely regretful at being taken off flying. His morale was rated good.

Case 26 : A sergeant wireless operator, aged 20, with 16 flying hours, was referred from a Radio School. His symptoms were continuous nausea followed by headache, and occasional vomiting on 11 out of 15 trips. Symptoms persisted after landing for 1 hour. There was a history of motion sickness on the sea, buses and swings. A maternal aunt suffered from psychological illness. He was sensitive at school and did not like being shouted at ; was nervous of the dark and had a night-light till he was 12 ; swam but was too timid to dive ; was over-anxious about being late for engagements or missing the last 'bus back to camp ; was disturbed by murder stories and was frightened of guns and thought it wrong to shoot animals. On the credit side he was sociable and joined the A.T.C. because there were no clubs near his home. At the interview he gave the impression of psychological immaturity. He said that he was at first nervous of flying but after 6 hours got over this and liked it. He appeared genuinely anxious to continue his training despite the airsickness. His commanding officer stated : "Expresses a sincere hope that this sickness may be overcome as more experience is forthcoming. Somewhat nervous and highly strung but very definite in his desire to carry on and become fully qualified." Morale was rated good.

It appears from Table V that there is no relationship between the presence of the milder degrees of predisposition to neurosis and the likelihood of suspension from flying training for airsickness. The position is that predisposition to neurosis if it is considered so severe as to have warranted rejection for flying training constitutes a disability to the airsick member of air crew by reason of :—

(i) Increasing the likelihood of superimposed neurosis.

(ii) Lowering the threshold for airsickness.

(iii) Undermining the man's ability to endure the airsickness.

Less severe degrees of predisposition appear to play a relatively small part in the disability, as may be seen in Table VI.

TABLE VI

Analysis of cases of airsickness with evidence of neurotic predisposition

Predisposition contributed to	Degree of predisposition			Total
	Severe	Moderate	Slight	
A. Airsickness	3	2	5	10
B. Inability to endure airsickness ..	4	8	4	16
Total in which predisposition contributed to 1 or 2	7	10	9	26
Predisposition did not contribute to 1 or 2	2	5	18	25

This table shows that predisposition when relatively severe was usually considered to have contributed to the disability but that the slighter degrees contributed much less often. Considering all the cases together there was about an even chance (26 to 25) that predisposition would be considered to have contributed to the disability. The likelihood of a neurosis was, of course greatly increased by predisposition, since in the 9 cases with neurosis, predisposition was considered severe in 3 and slight in another 3.

(*g*) Morale

The morale factor as a cause of suspension was considered in each case independently of neurosis or neurotic predisposition, a rough assessment being made in four grades—good, fair, indifferent and bad. The data for the assessment included the severity and frequency of the airsickness, the man's attitude towards flying ascertained as described in paragraph 2 and the executive report.

Out of the total number of 120 cases morale was assessed as indifferent or bad in 21. For purposes of comparison with the final judgment of the investigators the executive reports were assessed separately. (In 16 cases the executive report failed to provide adequate information for an assessment.) Analysis showed that in the judgment of the executive there were 25 cases of indifferent or bad morale.

(*h*) Discrepancies between assessment of morale by the investigators and the executive

In the whole series there were 11 cases in which there was a difference of more than one grade of assessment between the final judgment of the investigators and that of the executive. In 8 of these cases the executive assessment was indifferent or bad when the final judgment was fair or good, in the other 3 cases the position was reversed, the executive report being fair or good when the final judgment was indifferent or bad. In the 8 cases in which the executive had in our opinion significantly underrated morale the main reason in 5 appeared to be failure to appreciate the severity of the airsickness. This may be due to a variety of causes. The case may be one in which there is intense and persistent nausea with relatively little vomiting and the man has relatively little to show for his disability: the man may have lost keenness for flying duties owing to the severity of his airsickness, and his lack of keenness have been recognised without recognition of its cause: or the late recognition of airsickness which has been present from the beginning but has not been reported (sometimes because it has been concealed) may have been taken as evidence of poor morale. In the other 3 cases the executive had failed to appreciate that the man's incapacity was due to neurotic predisposition and that considering his handicap he had tried his best. The following case summaries illustrate some of these points :—

> Case 33: A sergeant wireless operator, aged 20, with 40 flying hours, was referred from an A.F.U. His symptoms were persistent nausea unrelieved by occasional vomiting and headache. Symptoms persisted for 6 hours after landing. He stated that he had vomited on 80 per cent of all trips. There was no previous history of motion sickness nor any evidence of neurotic predisposition. He had been originally ordered to report sick by his instructor and had treatment without benefit. The executive report stressed his lack of keenness to continue flying, their report indicating indifferent morale. The investigators found morale good. He was a stable and sensible man with good motivation who had rightly concluded that his airsickness was incapacitating.

> Case 78: A sergeant air gunner, aged 19, with 120 flying hours, was referred from a H.C.U. His symptoms were persistent nausea and vomiting repeated 6 to 12 times during the trip. Symptoms persisted for one hour after landing. At his A.G.S. he vomited on 10 per cent of trips: at O.T.U., 50 per cent: at H.C.U., 80 per cent. He stated that at the O.T.U. he had concealed his airsickness and had not reported sick, hoping for improvement. At the H.C.U. he was told to report sick by his captain.

There was a previous history of motion sickness in trams only. Physically and psychologically he was immature for his age, and rated on this account as having slight neurotic predisposition. His motivation for joining air crew was sound, and he appeared genuinely depressed in a rather childish way by his inability to carry on. The executive opinion was that 'he suffers from airsickness and intends to make the most of it as he is not keen to operate.' Morale, therefore, was in their judgment bad. In the judgment of the investigators it was fair. It was thought that his neurotic trait had contributed in some degree to his incapacity, and also to a false assessment of morale by the executive.

In the last of these cases the underrating of morale by the executive was considered to be partly due to their failure to appreciate neurotic predisposition as a factor which impaired the man's capacity to endure airsickness. The distinction may appear to the layman a fine one but is none the less real. When it is a question whether airsickness can be endured without incapacity the man with a neurotic constitution may fail, having tried his hardest, when another more robust individual succeeds. Case 60 (page 291) provides another example. This man with severe neurotic predisposition had persisted with flying duties despite severe airsickness and continuous fear, and had eventually lost hope of succeeding and had become depressed. The executive report of his morale was bad, stating that he showed no enthusiasm whatever either on the ground or in his keenness to fly. Their observations were correct but their interpretation, in our opinion, was wrong.

In Case 37 (page 288), a man with severe neurotic predisposition and persistent fear of flying had made several attempts to carry on and had developed an anxiety neurosis which was related more to his fear of failure than concern for his own safety. The case was wrongly diagnosed as airsickness. His morale was assessed by us as good. The executive, however, reported it as bad considering that he had the ability to fly but did not desire to do so. Again, the psychiatric interpretation differed from that of the executive owing to a fuller appreciation of what was going on in the man's mind.

In the three cases in which the investigators judged that the executive had significantly overrated morale the psychiatric interview revealed features in the personality and in the man's attitude towards flying which in each case were related to neurotic predisposition and indicated less than an adequate attempt to carry on. Case 98 (page 291) provides an example. The airsickness in this case though genuine was not severe and the psychiatric evidence suggested that the keenness to fly noted by the executive was a pose. In a second case also the airsickness was of moderate degree and had in our opinion been exaggerated. This also was the opinion of the Medical Officer though the executive did not agree. His morale was assessed by the investigators as indifferent, by the executive as good. In the remaining case the airsickness was severe and would have eventually led to suspension but the man was a Southern Irishman with unsatisfactory motivation for volunteering for air crew duties and a poor work record, had reported sick of his own accord after his first experience of airsickness, and had decided early that he could not carry on, being suspended at his own request after 19 flying hours. His protestation of keenness to fly which was accepted by the executive as genuine, with an assessment of good morale appeared to us inconsistent with the rest of the story, and our assessment of morale was indifferent.

(*i*) Relation of morale to other psychological factors

In order to relate the morale factor to those which have already been analysed the final assessment of morale was considered separately in four groups of cases—those with neurosis, those with neurotic predisposition contributing to suspension, those with neurotic predisposition not contributing to suspension; and those without neurosis or neurotic predisposition. The results are shown in Tables VII and VIII.

TABLE VII

Proportion of cases showing poor morale

Type of case	No. of cases	Cases of poor morale	
		No.	Percentage
Cases of neurosis	9	4	44·4
Predisposition contributing to disability ..	21	10	47·5
Predisposition not contributing to disability ..	25	1	4·0
Cases without neurosis or predisposition ..	65	6	9·2
Total cases	120	21	17·5

TABLE VIII

Assessment of morale	No. of cases	Percentage of each morale group in which there was also		
			Predisposition	
		Neurosis	Contributing	Not contributing
Good or fair	99	5	11	24
Indifferent or bad	21	20	50	5

There are several points of interest in these figures. First, in the 9 cases of neurosis morale was indifferent or bad in nearly half. A man suffering from a neurosis may, of course, have good or bad morale. The medical diagnosis and the ethical judgment are distinct though the distinction may sometimes be difficult. The assessment of morale depends upon how far the man has made the best of his qualities with full allowance for the handicap of illness. This is not to say that his illness in itself is not disabling. A man with a physical illness, for example, a duodenal ulcer, has a disability but we may assess his morale by his attitude towards the total situation including the severity of his symptoms, his obligations to others and his willingness to endure discomfort for the sake of fulfilling them. Examples have already been quoted under neurosis (pages 288–290) of cases with varying assessments of morale. In hysteria, which by definition is an illness from which the sufferer derives real or fancied gain, we believe there is usually some element of conscious motivation which is itself evidence of poor morale. Of the 4 cases of neurosis with poor morale, 3 were diagnosed as hysteria. The other (Case 15, pages 288–289) was a case of anxiety neurosis.

Nearly half of all the cases with indifferent or bad morale fall into the group in which there was no neurosis, but neurotic predisposition was thought to have contributed to airsickness or incapacity. This may mean either that neurotic predisposition when contributing to suspension for airsickness does so in many cases because it is a contributing factor to poor morale, or simply that in any case of airsickness the combination of such predisposition with poor morale, is especially likely to lead to suspension.

There is probably some truth in both these interpretations. By contrast the incidence of poor morale in cases of predisposition which was not thought to have contributed to suspension was low. Finally it is to be noted that in the whole series of 120 cases there were only 6 cases (5 per cent) in which indifferent or bad morale appeared to have contributed to suspension without evidence either of neurosis or neurotic predisposition.

4. Relative frequency and importance of psychological factors as a cause of suspension

The analysis has so far shown that in the 120 cases of this series psychological factors, including the morale factor, contributed to suspension in some degree as follows : Neurosis in 9 cases (7·5 per cent), neurotic predisposition without neurosis in 21 cases (17·5 per cent), and indifferent or poor morale without either of the other factors in 6 cases (5 per cent), a total contribution of psychological factors in 36 cases (30 per cent).

In one case (Case 37, page 288) the neurosis, which had been mis-diagnosed as airsickness, was the sole cause of suspension. In the remaining 35 cases the symptoms were those of true airsickness in which the essential cause is failure at the physiological level to adapt to the motion of the aircraft. An attempt has been made in each of these cases to determine whether psychological factors were of major importance, that is to say whether they were more than half responsible for suspension. As we have already indicated, psychological factors may operate in two different ways. First, they may contribute to physiological failure of adaptation. Thus, it is possible that in airsickness of disabling severity psychological factors may have been of major importance. Second, they may undermine the man's capacity or will to endure airsickness, and operating in this way may be of major importance either by leading to suspension for a mild and non-disabling degree of airsickness, or by leading to suspension for a severe and probably disabling degree of airsickness some time before the average man would have succumbed. Both modes of operation may be apparent in the same case. Examples of the mechanisms concerned have been given in the sections dealing with Neurosis, Predisposition to Neurosis, and Morale. Analysis has confirmed our impression that in the great majority of cases in which psychological factors contributed the clinical picture was that of a severe airsickness which either was, or would ultimately have been, disabling, for in 29 (82 per cent) of the 35 cases now under consideration vomiting had occurred on more than half the trips on the course prior to suspension. In 21 (60 per cent) of the 35 cases, however, psychological factors were judged to have been of major importance in determining the fact or time of suspension. This number was made up of 7 cases of neurosis, 11 cases of neurotic predisposition without neurosis, and 3 cases of poor morale without either of the other factors. The addition of the case of neurosis in which there was no airsickness brings the total number in which psychological factors were of major importance to 22 (18 per cent) of the 120 cases referred to us.

5. The psychological factor in relation to the stage of training at which suspension occurred

We have encountered the belief that when airsickness leads to suspension in the later stages of training psychological factors are the common cause. We have analysed our material with reference to this possibility for navigators, wireless operators, air gunners, air bombers and flight engineers, taking each category separately on account of the differences in the training programme. The findings are presented in detail for the benefit of those interested in the several crew categories (*see* Summary, pages 283–285).

(*a*) Navigators

Of 43 navigators, 16 were referred after graduating from an Operational Training Unit. In 9 of these cases the man's story was of vomiting on more than 50 per cent of trips at each stage of his training. In one of them, there was a neurosis with bad morale and psychological factors were considered to be the major cause of suspension, and in 2 others a slight degree of neurotic predisposition was a minor contributory factor.

Among the 7 cases in which there was a history of vomiting on less than half the trips at some stage of training, in one an anxiety neurosis was the major cause of suspension, and in 3 others neurotic predisposition (1 case) or poor morale (2 cases) were contributory factors of minor importance. In 2 of the other cases vomiting was relatively infrequent, but nausea was present on almost every trip and was severe, persistent and often incapacitating. In the remaining case there had been a progressive failure of adaptation with vomiting on half the trips at the Operational Training Unit.

Thus, of the 16 cases there were 2 in which psychological factors were of major importance, 5 in which they were of minor importance, and in the remaining 9 there was disabling airsickness without any psychological factor.

(*b*) Air gunners

Of the 27 pupil air gunners, 7 were referred after graduating from the Operational Training Unit and of these 4 gave a story of vomiting on more than half the trips at Operational Training Unit. In one of these, neurotic predisposition was a factor of major importance.

Of the 3 men with a story of vomiting on less than half their trips at Operational Training Unit there were two in whom psychological factors (in both instances severe predisposition and indifferent morale) were of major importance. The other man provided a characteristic example of progressive failure of adaptation with exposure to violent manoeuvres with no evidence of any psychological factors. His captain's report summarises the case well: "X has been my mid-upper gunner for the last six months. During this time I have completed 120 hours flying. While doing normal flying at Operational Training Unit this gunner was occasionally affected by airsickness during bumpy conditions. However, since converting on to four-engine aircraft and practising evasive manoeuvres (corkscrews, banking search, etc.) he has been persistently sick to such an extent that he has been unable to carry out his duties above oxygen height. Although he is a very keen, reliable and co-operative crew member, I consider him unfit for operational flying."

Thus of the 7 air gunners referred from a late stage of training there were 3 in whom psychological factors were present and in each case they were of major importance. In the other 4 cases there was satisfactory evidence of disabling airsickness.

(*c*) Wireless operators

Of the 27 wireless operators, 6 were referred after graduating from Advanced Flying Units. Of these, 2 were uncomplicated cases of severe airsickness with vomiting on not less than 75 per cent of trips at any stage of training. In a third case, again a man of good morale without neurosis or predisposition, there had been a progressive failure of adaptation. The remaining 3 men were all suffering from a neurosis, though in one case the psychological factor was not considered to be of major importance as he had been treated for and was recovering from his neurosis at a time when his airsickness in relation to evasive manoeuvres was becoming worse.

(*d*) Air bombers

Of 7 pupil air bombers, 1 was referred after graduating from the Advanced Flying Unit. He gave a history of vomiting on 50 per cent of trips at all stages of training. There was no neurosis or predisposition and his morale was excellent probably contributing to his having got so far.

(*e*) Flight engineers

Of 9 pupils in this category, 1 was referred after graduating from a Heavy Conversion Unit where he had vomited on 30 per cent of trips but had been quite comfortable on 50 per cent. When airsickness did occur, however, it was persistent and incapacitating. At the Lancaster Finishing School he vomited on 5 out of 7 trips, being completely incapacitated by corkscrews. There was no neurosis or predisposition and morale was good.

(*f*) Summary

Thus, out of 113 men who were under-training in the categories mentioned, 31 were referred at a late stage of training. Sixteen of these gave a history of airsickness so frequent and severe that they should have been eliminated at an earlier stage. Among these 16 cases there were 4 in which psychological factors contributed, being of major importance in 2 (12·5 per cent). Among the 15 cases with a history of less severe airsickness there were 9 in which psychological factors had contributed to suspension, being of major importance in 5 (33 per cent). In the other 6 cases there was a satisfactory explanation for the late development of disabling airsickness without any psychological factor. The conclusion arrived at is that in half the cases suspended for airsickness at a late stage of training the cause of late suspension has been failure to detect the disability earlier. When, however, the history of airsickness carefully obtained reveals that on the course preceding that of suspension the frequency of vomiting was less than that which is usually disabling there is a probability that psychological factors will be discovered, and that they will be of major importance.

With regard to the morale factor in this group of late suspensions for airsickness, among the 31 cases there was 1 with an assessment of bad, and 4 with an assessment of indifferent morale, but no case in which poor morale alone was considered to be the factor of major importance in causing suspension.

6. Constitutional motion sickness

Evidence of a previous history of motion sickness was obtained as follows :—

	Percentage
On the sea	45
In cars or buses	48
In trains or trams	40
On swings	55
With other movements, e.g. roundabouts, fun fairs	14

In only 19 (16 per cent) could no previous history of motion sickness be obtained, and in 58 per cent sickness had been experienced in more than one of these groups.

Unfortunately the standards upon which a positive history of motion sickness are based vary so much that it is difficult to compare these figures with those of other observers. By our standards any motion sickness sufficiently severe to be remembered by the patient, even though it occurred in childhood and had since ceased, would be noted. Eighty-four per cent of our series gave a positive history of motion sickness of some kind as measured by this standard. This compares with a figure of 58 per cent in 19 airsick eliminees from navigation reported by McDonough (1943) and 63·4 per cent in 107 airsick eliminees of various categories reported by Hemingway (1943).

7. Discussion

We have found few papers in the literature devoted especially to the psychological aspects of airsickness, and in those to which we have had access there is difficulty at times in following the argument owing to differences of definition. Armstrong (1943) after stating that airsickness is simply a particular form of vertigo includes as a cause of vertigo "fear produced by being at or looking down from high places" and develops the argument that vertigo resulting from motion excites unconscious fear and that this is the cause of vomiting of airsickness "which is nothing more or less than the natural reaction of the body to a state of fear whereby it rids itself of all unnecessary impedimenta in preparation for fight or flight." According to this view the primary cause of airsickness may be accelerations, or the fear of high places. The secondary cause is a psychogenic state in which there is a conflict between the instinct of self-preservation and the situation. Armstrong supports these arguments with the observation that some individuals are airsick in straight and level flight at constant speed in calm air, and that symptoms of airsickness may persist for as long as forty-eight hours after a flight. He considers that as there is no physiological explanation for such phenomena they must be psychogenic.

We cannot agree either with his use of the word vertigo or with the arguments which follow. Vertigo as Gowers (1887) argued should be restricted to sensations resulting from disordered function of the labyrinths or their central nervous connections. These sensations though they may show many variations fit into a specific pattern. There is a sense of movement in self or surrounding objects which may or may not be associated with actual disturbance of bodily equilibrium. Fear of falling, conscious or unconscious, does not produce vertigo as thus defined. The nausea, sweating, pallor, vomiting, headache and other symptoms associated with vertigo, and equally associated with motion sickness, are the result of reflex physiological disturbance, and need no explanation in terms of psychopathology.

The occurrence of airsickness under conditions in which motion is minimal may be compared with seasickness in like circumstances. Neither in the air or on the sea is there ever complete freedom from motion. It is more reasonable to assume a high degree of physiological susceptibility than psychogenic factors. The same comment is applicable to the persistence of symptoms of airsickness after landing. Clinical experience of the effects of stimulation of the labyrinth and vestibular nerve shows that symptoms may persist for many hours after the stimulus has been removed. Apart from these observations we detect in Armstrong's reasoning the tendency to assume that when there is no physiological explanation forthcoming for an obscure clinical phenomenon the cause must necessarily be psychogenic. Such an assumption is unjustified. Psychogenesis canot be argued from negative conclusions but needs positive proof.

Bond (1943), in a valuable study of the emotional factors involved in a group of 30 consecutive airsick eliminees among navigation cadets in America, judged the emotional factor to be predominant in 15, and emotional maladjustment an important factor in a further nine. As prima facie evidence for psychogenesis in some of his cases he mentions the liability to airsickness in level flight and calm air and the variety of special causes for airsickness given by different individuals. The first of these points we have already discussed. The second we believe may have a physiological explanation which applies also to Bond's observation that in the past histories of motion sickness there was much variation in the type of vehicle or motion responsible and that this also suggested a psychological cause. There is no doubt from our own observations which simply confirm those of others, that different individuals may be susceptible to different types of motion whether in the air or in other conditions. We have examples of men who have been frequently sick in trams but not in cars or buses, of others who were sick on amusement devices which involved rotation round a fixed point with exposure to centrifugal force (chairoplanes) but were never sick on switchbacks, and vice versa. So also in the air there are men with little susceptibility to rough weather, who are highly susceptible to the manœuvres of fighter affiliation or corkscrews. We have noted such variations in men in whom we could detect no psychological abnormality. Little is known of the physiological basis for undue susceptibility to motion but, if as we suppose it is due to variations in the function of the labyrinths and their central connections, it is not unlikely that such variation might be specific in certain individuals for certain planes or periodicities of motion. The probability of such an explanation is at least as great as that of a particular emotional significance advanced by Bond. This is not to say that psychological factors may not be important or to detract from McDonough's (1943) generalisation with regard to the multiplicity of aggravating factors that "the cause of airsickness is motion, but the concurrent appearance of many other factors that are specifically disagreeable to the particular individual either through previous association or a neurotic background, often reduces the amount of motion necessary to a minimum." We have given examples in the analysis of our material which support this view. The question, however, is how *often* psychological factors are important. Bond gives summaries of 18 of his cases which we have attempted to review by the standards used in our investigation. Four we should probably have regarded as suffering from a neurosis contributing materially to the cause of elimination. In the remaining 14 cases we should have found evidence of neurotic predisposition in 13, with evidence of contribution either to the airsickness or the cause of withdrawal in eight. Bond himself says that the presence of neurotic trends does not necessarily mean that these have contributed to disability from airsickness, and gives an excellent example (not included in his 30 cases). Nevertheless he appears to us in the analysis of his material to err in the direction of assuming that whatever psychological abnormality was found had been a causal factor. It is clear, however, that the incidence of neurosis and of neurotic predisposition was considerably higher in his series than in that which forms the basis of the present report. The discrepancy may well be due to the difference between Bond's material and our own. The men whom he examined were all willing to be eliminated from navigation training after an average of eight flights, none having completed more than 20. We suggest, therefore, that this was a group of men who were to some extent self-selected by their willingness to be eliminated at a very early stage of training. In such a group one would expect to find a high incidence both of neurosis and of the more severe degree of neurotic predisposition contributing to withdrawal.

Fraser (1944) in a series of 80 consecutive cases of airsickness referred for investigation in Australia found 32 with evidence of neurotic adjustment, and 12 others with doubtful adjustment. His material differs in an important respect both from ours and Bond's, for his subjects were a consecutive series, not of eliminees, but of men who had reported sick, either of their own accord or by order of their instructors. Fraser follows Armstrong and Bond in making what he calls physiological inconsistency in the symptoms one of his criteria for a diagnosis of neurotic adjustment, including airsickness without any constant relationship to rough weather or violent manœuvres, remissions, delayed failure of adaptation, and persistence of symptoms for more than three hours after landing. We have already stated our objections to this line of reasoning derived both from theoretical considerations and our own records. Fraser based his psychological assessment upon analysis of the material under five headings :—

(*a*) Neurotic motivation for entry.

(*b*) Existing emotional over-dependence.

(*c*) Present anxiety.

(*d*) Somatic conversion symptoms (including psycho-somatic instability, i.e. liability to syncopal attacks, biliousness).

(*e*) Physiological inconsistency,

and presents case summaries of 31 of the 32 cases considered to show neurotic adjustment on the basis of positive ratings under these headings with scores ranging from 1 to 4. He makes no distinction between neurotic constitution and actual neurosis, though admitting the possibility of the fortuitous incidence of airsickness in an emotional background. He implies that when neurotic adjustment was found it contributed to the airsickness but does not always provide evidence in support of this assumption. In some of his cases the evidence of neurotic predisposition appears to us to be doubtful, for example, when it is based upon physiological inconsistency and a history of bilious attacks, or other physiological instability (classified under somatic conversion symptoms). Analysis of his 31 case summaries in an attempt to compare his material with our own suggests that the incidence of neurosis in his series and ours was similar and that as in our own series the more severe degrees of predisposition contributed to disability in an important degree, whereas the slighter degrees of predisposition rarely did so.

McDonough and Bond (1944) believe that symptoms identical with airsickness may be caused by emotion and that it may be difficult therefore to decide what element is ætiologically paramount in an individual case. We submit that the first part of this generalisation is inaccurate. It is true that in certain cases the main cause of airsickness may be psychological. In such cases, however, the psychological factor operates indirectly by lowering the threshold of physiological tolerance for motion. The symptoms, therefore, are those of airsickness, not of psychological disorder. Apart from this, psychological disturbance may be the direct cause of symptoms which superficially resemble those of airsickness. These symptoms, which are the visceral accompaniments of emotional tension, have no special connection with flying except that the usual source of the emotional tension is fear, and fear, though it may be excited by many other circumstances, is commonly experienced in the air. When anxiety is the direct cause of disordered visceral function in the air the symptoms may be confused with those of airsickness but there are several points of distinction. The sufferer from airsickness becomes gradually, though sometimes rapidly, aware of malaise related to motion, and the subsequent development of nausea and vomiting is accompanied by a feeling of limpness and apathy. The symptoms of an anxiety state arise from emotional distress which the sufferer can usually describe, though he may be only partially aware of its origin, and if nausea and vomiting supervene they are accompanied by an increase of emotional tension whose peak coincides with that of the visceral disturbance. At the height of his symptoms the man with airsickness sometimes expresses his feelings by saying that he would not care if he were dead. The sufferer from an anxiety state in the air is usually afraid of being killed, whether he is prepared to admit it or not. Case 37 (page 288) in our series provides an example of the introspective distinction between the symptoms of airsickness and anxiety. We have met with several others, and have been informed that nausea and vomiting at moments of acute anxiety in the air, for example, in aircrew of night bombers over the target area, have been observed on many occasions. Symptoms of this kind and cause, however, are not the symptoms of airsickness. They are anxiety symptoms in the air and should be so called.

It would appear from the material presented in this chapter that the incidence of neurosis in men about to be suspended for airsickness is more than twice as high as that which we have found for all flying personnel of the Royal Air Force (Symonds and Williams, 1943). This we interpret as due to two causes. First, if an anxiety neurosis develops in a man with a liability to airsickness, the airsickness is likely to be aggravated and to appear as the presenting symptom. Second, if a man with airsickness develops hysteria the airsickness is likely to be utilised as a part of the escape mechanism. All our cases of neurosis (except Case 37, page 288) have fallen into these two groups.

The part played by neurotic predisposition without neurosis has already been discussed under that heading. There is no doubt that it may contribute to the severity of airsickness, or the inability to endure airsickness without incapacity, and it is therefore one of the variables which must be considered in the ætiology. There is equally no doubt that neurotic predisposition and incapacitating airsickness may co-exist without any causal connection. In studying this aspect of the problem of ætiology we were looking especially for neurotic predisposition (as distinct from a neurosis) as a causal factor but found it present in only 21 cases, whereas in 25 other cases neurotic predisposition was recognised but appeared to have no causal significance. It must be admitted that the definition of neurotic predisposition is arbitrary, that our standards may differ from those of other investigators, and that in an interview limited to one hour causal significance may not be detected. Since the measure of clinical definitions and standards is at best a rough one we append one or two of our case records in full in order to illustrate the methods employed (pages 306–307).

What has been said in qualification of our assessments of neurotic predisposition as a cause of suspension for airsickness also applies to the morale factor with the important exception that we had here the independent reports of executive officers which in most instances were factual and detailed. It has been noted that in comparatively few cases was there any material discrepancy between the final assessment of morale and that given by the executive report. In only 21 cases was defective morale finally judged to contribute to suspension, and in only three of these was it considered to be the only psychological factor present and the main cause for suspension. As this finding contradicts a widespread impression it must be considered further. It has been alleged that withdrawal from flying on account of airsickness in the later stages of training is in many cases due to fear of the imminent hazards of the operational tour, and in support of this we have been told that if one or two men at the O.T.U. stage question their ability to continue training on account of airsickness their example may be followed by several others. Our analysis has provided very little support for this allegation. Our impression is that half the men who are suspended at a late stage have endured typical severe airsickness with unusual fortitude, and have been encouraged either by their own optimism or by their instructors to continue flying. When they are crewed up at the operational training unit their incapacity for operational duties becomes apparent both to themselves and to other members of the crew, and they are more likely and more willing to be eliminated. There are probably always some men with a doubtful prognosis, who are encouraged to persist by the example of others. If one or two men report airsickness it is likely that others will follow, not because they are afraid of the operational prospect but because they are genuinely uncertain of their fitness for operational duties.

There is another group of men suspended at a late stage, in whom the history of airsickness is atypical. Critical examination of the story reveals that in some of these atypical cases there is incapacitating airsickness of physiological origin. Our impression is that insufficient allowance has been made for late failure of adaptation due to physiological factors, such as evasive manoeuvres, a new type of aircraft, and increase in the frequency and duration of the trips, and for incapacity due to persistent nausea with relatively infrequent vomiting. When allowance had been made for such causes 6 out of 15 cases in our atypical group of late suspensions were judged to be suffering from incapacitating airsickness without any psychological factor. Psychological factors contributed in the other 9 cases and were considered to be of major importance in 5, but there was no case in the late group of suspensions in which defective morale alone, that is to say without neurosis or neurotic predisposition, was the factor of major importance. Our observations therefore suggest that the impression that lack of moral fibre is a common cause of late suspension for airsickness is unfounded and that it has arisen from failure to appreciate :

(i) that a number of men with a typical history of severe airsickness throughout training arrive at the late stages before their disability is brought to notice ;

(ii) that there are atypical varieties of true airsickness which are incapacitating ;

(iii) that psychological factors other than defective morale may lead to suspension.

An additional argument against supposing defective morale to be a frequent cause of suspension for airsickness is the significantly small number of pilots found in this series. It is generally accepted that the incidence of airsickness among pilots is low for reasons which are probably connected with their occupation and position in the aircraft, but there is no reason why they should be immune from the morale factor. If last-minute fear of operations were an important cause of late suspension one would certainly expect pilots to be represented in this group whereas among the 31 men suspended from the stage of Operational Training Unit or later, although all other categories of air crews were represented, there were no pilots.

8. Summary and recommendations

(1) A study has been made of the part played by psychological factors in leading to suspension from flying duties for airsickness. One hundred and twenty men who were to be suspended for airsickness were each interviewed for an hour. They were referred from stations representing all training units of Flying Training Command and Bomber Command at home, all aircrew categories being included. At the interview a detailed enquiry was made into the nature of the disability at all stages of training ; the past history of motion sickness ; the psychiatric history with a view to revealing any predisposition to neurosis and any evidence of neurosis ; and the man's attitude to flying. Executive and medical reports were available.

(2) The *symptoms* have been studied with especial reference to associated symptoms such as headache, dizziness and slowing of mental processes ; to the persistence of symptoms, especially after landing ; to failure of adaptation ; to the frequency and degree of incapacity ; and to special causes. It

has been concluded that the symptom pattern of airsickness may show many variations which are independent of psychological factors.

(3) *Neurosis* was present in 9 cases (7·5 per cent). In one case all the symptoms were those of â neurosis. In 7 of the other 8 cases the neurosis was judged to have been of major importance in leading to suspension. In these the neurosis either caused loss of adaptation to motion, aggravation of existing airsickness or failure to endure it. A distinction is made between true airsickness (motion sickness) and the visceral accompaniment of a neurosis.

(4) *Predisposition* to neurosis was recognised in 51 cases (42·5 per cent). It was severe in 9 (7·5 per cent), moderate in 15 (12·5 per cent), and slight in 27 (22·5 per cent). The proportion of severely predisposed men is greater than in normal aircrew continuing training. Three of the severely predisposed men had a neurosis and in one this was the sole cause of the disability, while in the other two it contributed to it to a major extent. In 4 of the 6 without a neurosis severe predisposition had contributed to the disability either by lowering the threshold for airsickness or by weakening the man's capacity to endure it. In the other 2 the predisposition though severe did not seem to have been a cause of the man's suspension for airsickness.

Although severe predisposition is likely to contribute materially to disability caused by airsickness, less severe degrees of predisposition play little part—out of 42 with moderate or slight predisposition, the predisposition was considered to have contributed to the disability in 19, and to have played no part in 23. In 11 cases predisposition appeared to have been of major importance in leading to suspension.

(5) *Morale* assessed separately from neurosis or predisposition was considered indifferent or bad—as opposed to fair or good—in 21 of the 120 (17·5 per cent). The difficulties which face the executive in assessing the morale factor are discussed in some detail. Morale was defective in nearly a half of those with neurosis and of those in whom predisposition contributed to suspension, compared with 9 per cent of those without neurosis or predisposition. In only 3 cases was poor morale alone, without any other psychological factor, judged to be of major importance.

(6) The part played by *psychological factors*—neurosis, predisposition or morale—was analysed in relation to the stage of training at which suspension occurred in each air crew category. In view of the importance attached to these factors when suspension occurs late in training especial attention was paid to their contribution in men at O.T.U. or later. In half of these cases the cause of late recognition was failure to detect typical incapacitating airsickness earlier. When, however, the disability on the course preceding that of suspension appeared less severe, psychological causes were often present and when present were usually of major importance. Defective morale rarely contributed to suspension late in training.

(7) *Constitutional motion sickness* was recognised in the previous history in 84 per cent of the cases, and in 58 per cent it had been experienced with more than one kind of motion.

(8) The findings are discussed in relation to the views of other investigators, and the broad general conclusion is reached that—

When a man is suspended for airsickness at any stage of training the cause is usually motion sickness uncomplicated by psychological factors. Psychological factors—either neurosis, neurotic predisposition or faulty morale—may contribute by lowering the physiological threshold for tolerance of motion, or by reducing the man's ability or willingness to endure symptoms ; but psychological abnormality may coexist with airsickness without contributing to it. As a cause of suspension *for airsickness psychological factors are seldom of major importance. Psychological factors are never the direct cause of true airsickness which should be clearly distinguished from visceral reactions to anxiety occurring in the air.*

(9) In view of the delay and difficulty attending suspension for airsickness in the later stages of training owing to lack of evidence we recommend the adoption of a standard method of recording airsickness for each member of air crew on each course. The records for all previous courses should accompany the man to his next course and they should include notes upon the frequency of the airsickness, the main symptoms, the frequency of incapacity due to airsickness, the degree of adaptation to motion during the trip or course, and the nature and maximum duration of symptoms after landing.

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APPENDIX

METHODS OF ASSESSMENT OF NEUROTIC PREDISPOSITION AND MORALE

Illustrative case histories

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1. **Moderate predisposition**

Case 53 : A Pilot Officer, Air Bomber, with 400 flying hours, was referred from an O.T.U. where he was instructing after an operational tour on night bombers, which was terminated after 22 sorties on account of airsickness. The story of his airsickness was typical, with persistent failure of adaptation. His father was a sheet metal worker, who was said to have had shell shock in the last war and suffered from tics. His mother was described as a highly strung, excitable worrier and he was the only child. At about the age of 4 he was taken to a doctor because he was frightened of the dark and could not sleep, and was said to have St. Vitus' dance (probably tics). From these symptoms he did not fully recover until he was 9. He also had a phobia of heights, e.g. looking over the side of a steep hill. At school he was average at work and above average at games, his best performance being in long distance running. He swam and dived. Though he was shy of girls he made many friends, but his school days were unhappy because of nervousness. When working by himself he did well but in competition became over-anxious ; thus his examination marks were always below the level of his average performance through the term. He was more at ease in team games than single events, suffering a good deal from tension before important events. Leaving school at 15 he worked in an accountant's office, living at home. His main hobby was playing the piano ; he also took part in club cricket and football and, overcoming his shyness, took to dancing. His holidays were spent camping with friends. He continued to be anxious. For example, if anything had gone wrong at the office during the day he could not close the door and forget it like others, and he worried when he had to take responsibility. In his social life he worried about what others thought of him. He checked his work over to an unnecessary extent. During one period he had obsessional desires to go back to the office and see if he had turned the light out. He realised this was absurd and drilled himself out of it. About once in two months he would have a period of two or three days when he was depressed and irritable without reason. This disturbed him enough to lead him to read a popular book on psychology, from which he inferred that his moods must be endured. He described himself as neither aggressive nor yielding, but if he bought a book he didn't want, would think twice about going to exchange it on account of his shyness. He was opposed to blood sports on principle and collected for the R.S.P.C.A. Having, however, been in Coventry and Birmingham during the raids he had no antipathy to bombing the enemy, although he did not enjoy it but felt that it was something to be done for the benefit of all. It was because he believed in retaliation that he volunteered for aircrew. At first very homesick he subsequently enjoyed service life. He was not nervous in training, but soon lost his enthusiasm on account of airsickness. After his first 10 sorties, having vomited on all, he told his captain he thought he was not efficient and should not carry on. The crew discussed the situation and were in favour of his carrying on so he did so. They had a fair share of stress during the tour, being hit several times by flak and once by a night fighter. He wanted to do a second tour if his airsickness could be relieved, because he thought bombing would be a decisive factor in winning the war.

Neurotic predisposition was rated moderate with the following comment : An extremely frank individual inclined to use superlatives in describing his airsickness but not his operational experiences, which he does not minimise either. He had good insight into all his neurotic tendencies and has been determined not to allow them to interfere with his success. Determination and persistence are the compensating qualities (with intelligence) which might have made the assessment slight, but one would not have guessed this before his flying career. The predisposition was thought not to have contributed to suspension. Morale was rated as good.

2. **Slight predisposition**

Case 121 : A Sergeant, Navigator, aged 21, with 150 flying hours, was referred from an O.T.U. His symptoms were those of typical severe airsickness, with vomiting on 75 per cent of trips at the Advanced Flying Unit. His father was a clerk. There was no family history of psychological abnormality. He himself suffered from asthma and nightmares in childhood. At school he was shy, always afraid of making a fool of himself and being laughed at, and did not play games at first because of his asthma. Later, when allowed to do so, he was timid of rough games because he did not like being hurt and avoided fights for the same reason, but was fond of swimming and diving. He mixed well and was average at his work. Leaving school at 16 he worked as a clerk for a year and then returned to school to train for the Roman Catholic priesthood. This was his own idea, somewhat discouraged by his parents. He then spent 2 years in a college away from home, made friends and enjoyed the life. His recreation was cycling. He was a careful rider and had no accidents. Before examinations he was anxious and would sleep badly though he did well. He was liable to fits of depression without cause, during which he would become miserable and his work would be slipshod ; and also had brief moods of elation. He had no obsessional tendencies. Being due to be called up with his age group he volunteered for aircrew because it was something he had never done and wanted to do. His father's attitude was neutral, but his mother did not object because of the long training and her hope that the war would be over before he operated. He found that he got on in the service better than he had expected. Having thought that coming from a religious house he would find it all very difficult, and having been afraid of being a 'Holy Joe,' he found he was more respected than mocked and made friends despite church-going. Although somewhat nervous to start with he soon became happy in the air except when airsick. He was regretful at the prospect of ceasing training, and suggested that he might be able to continue in an aircraft he could see out of. If grounded, he wished to make use of some of the training he had received. Neurotic predisposition was rated slight. The comment was : timidity, mild anxiety, and affective liability offset by a cheerful and persistent disposition. The predisposition was thought not to have contributed to suspension. Morale was rated good. The executive report merely stated that he suffered from incapacitating airsickness.

3.

No predisposition

Case 2 : A Pilot Officer, Air Bomber, with 120 flying hours. was referred from an A.F.U. with a typical history of incapacitating airsickness. His father was a healthy mining engineer, his mother had a phobia of water and would never go in boats and his two sisters had the same phobia. He was frightened of the dark till he was 10 and up till the present time ill at ease in a stuffy room. At school he was shy but mixed well and was not unhappy. At work and games he was above average and played association football for school, town, county, and Northern England. He swam and dived but, having tried boxing, he gave it up because not much good at it. After school he was apprenticed to engineering. His hobbies were cycling and hiking with friends, and later motor cycling. He was a careful rider, not easily frightened but taking no risks. He was not subject to mood swings, obsessionally neat but not uneconomically so. Examinations made him more anxious than the average, for he was preoccupied with the possible disgrace of failure, but always succeeded. He knew he would have to serve in one of the forces and his own home had been damaged by enemy bombing and friends killed, which stimulated him to get his own back. He wanted to be a pilot or air bomber. At Grading School he never felt confident of his own powers, being scared of the machine and the new element. He did not say so, for he would never admit he could not do anything. Having failed in grading he was quite content to be an air bomber. He stated that it was not his wish or decision to come off flying, but that his airsickness was interfering with his work. Although he would like to continue, he appreciated that if he were inefficient it would spoil a crew at the Operational Training Unit, so that he thought the best thing he could do now was to be as good as instructor as possible and train others. Predisposition was rated nil, the family and personal history of phobias and slight tendency to anxiety not being considered of sufficient weight for a positive assessment. The executive report was as follows : "This officer has been at this Advanced Flying Unit for 4 weeks. During this time he has continued his training as an air bomber and has flown for at least 30 hours. He has been found to suffer from airsickness. This airsickness does not appear to materially upset his work. The sickness affects the officer on practically every flight. The sickness, though not very severe, seems to give the officer a certain dread of its occurrence. Thus he is most unhappy in his job. Summing up, I consider him unfit for operational duties and recommend that his training cease. He is undoubtedly keen and may be very suitable for instructional purposes." Their rating of morale was assessed as fair. The investigators rated morale good.

CHAPTER XXII

RELIABILITY OF PSYCHIATRIC OPINION IN THE ROYAL AIR FORCE

by

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Introduction

Data on some of the R.A.F. psychiatric problems, which have been presented in Chapters IX, X, XI, XIV and XVII, were obtained from a specially designed system of card returns made by the R.A.F. neuro-psychiatric specialists. Each of the cards provided information upon a member of air crew who had been referred to the specialist by the station medical officer for an opinion as to the presence of psychological disorder. Some of the information on the cards was factual, e.g. the man's experience, in hours flown, of non-operational and operational flying, the aircraft he had flown, his squadron and the nature of his duties ; the remainder comprised the considered opinions of the neuro-psychiatrist upon the reaction type of illness, its main causes, the degree of stress experienced in flying and in other situations, and, lastly, upon the man's constitutional liability, or predisposition, to psychological disorder.

In reaching his conclusions on these points the psychiatrist will use the available factual data, all the relevant information that he can gather from the patient in the course of an interview, and the general picture that that patient presents to him during the interview. In other words, psychiatric opinion must, to a greater or less degree, resemble other forms of clinical opinion. It must be based upon accurate observation of signs and symptoms, and an appraisal of their development and related history, assessment of the relative importance of these various features, and finally a comprehensive judgment of the whole case. Experience and acumen will play important parts in the process, but clearly, even at their best, the most careful and objective judgments cannot have the reliability of observations made in a less complex situation or of characteristics which are open to measurement. While it must be admitted that such judgments will inevitably differ between one skilled observer and another, it is important to measure the scale of these differences. This depends on the frequency with which they will occur in a series of observations, and their size—whether the differences are relatively slight and unimportant or whether they represent extreme divergences of opinion.

This information has not so far been available and the reliability of psychiatric methods has been questioned both in relation to the management of flying personnel who have proved unequal to their task and to the detection of those who will be unequal to it. This reliability could be determined in an unselected population, either of air crew or of entrants, by an experiment involving the independent examination of each of the subjects by two or more psychiatrists, but opportunities for such an experiment, which is not without inherent difficulties, have not arisen.

An alternative method of approach existed in the card returns mentioned in the opening paragraph, for in a number of cases the member of air crew referred for examination had been interviewed by two psychiatrists, each of whom had made a card return upon the same man. Such duplicate returns offer a means of determining the agreements and disagreements between the psychiatric assessments on the cards. They have, however, certain defects which must be noted :—

(*a*) Some part of the opinion of the first psychiatrist to study the case would have been available to the second and this could have influenced the second observer in his judgment, though this lack of complete independence of the judgments is not thought to affect the results seriously (see below).

(*b*) The opinions mainly relate to men with a psychological disorder so that the conclusions could not be applied indiscriminately to the general population.

The second objection applies particularly to the assessment of predisposition to neurosis, for the level of agreement between psychiatrists on this point might obviously differ in a population that had already revealed its liability to neurosis as compared with a population that had not yet had the opportunity to do so. We should, therefore, be reluctant to transfer the present results without reservation to the sphere of selection at entry.

(*c*) The fact that two opinions were called for suggests that in some of these cases we may be dealing with the difficult rather than the straightforward problems ; disagreement might therefore be at a maximum.

1.

The data

Under the reporting system already described in Chapter IX a card is submitted for every member of an air crew seen by a neuro-psychiatrist. The directions were explicit and that definition was made as rigorous as seemed possible in psychiatry.

During a period of nearly two years just over 5,000 cards were returned and it was found that in 541 of these cases the patient had been seen by more than one of the 37 psychiatrists then at work. The first psychiatrist had usually seen the man in a N.Y.D.N. Centre and the second either at the Central Medical Establishment, London, in hospital, or at another Centre. The intervening period was usually many days, often some months, but the opinions always referred to the same illness. The card filled in by the first psychiatrist was not available to the second but his opinion on the medical history sheet (Form 39) often was. This form does not include the detailed data on the card but does contain a short statement of the first psychiatrist's opinion which was therefore capable of influencing the second psychiatrist's judgment. The form of the opinion, contained in a few sentences, was quite different from the information required on the card and it is thought that the results given here are unlikely to have been seriously affected by this lack of complete independence. The aspects of the case upon which the psychiatrist was required to give his opinion were as follows :—

(*a*) The reaction type of the disorder under 9 diagnoses.

(*b*) The main causes of the disorder.

(*c*) Whether or not the disorder had been caused by flying duties.

(*d*) The degree of flying stress, under 5 grades, to which the man had been exposed.

(*e*) The degree of psychological stress apart from flying, under 3 grades, to which the man had been exposed.

(*f*) The man's predisposition to neurosis under the 3 headings nil, mild and severe.

For each of these characteristics, except the causes, a table has been constructed to show the opinions reached by the first and second psychiatrists to study the case. It may be noted that the tables do not relate to a particular pair of psychiatrists but to any of the 37 who saw flying personnel during the period under review, the differentiation in the tables merely being between the specialist to see the patient first and the specialist to see him second. We are, too, not concerned here with whether the opinions are right or wrong, but merely with whether they agree.

2. Results

(*a*) *Reaction type.*—Psychiatrists were required to confine their diagnoses to one of 9 reaction types : *anxiety state, depression, elation, hysteria,* a *fatigue syndrome,* an *obsessional neurosis, schizophrenia* or an *organic disorder,* acute or chronic. If the subject were not considered to have a neurosis at all, or any disqualifying organic disease, but declared his inability to continue his flying duties he was classified as suffering from *lack of confidence.* The diagnoses made on this basis by the two psychiatrists to see each subject are set out in full in Table I.

TABLE I

Reaction types : the number of cases diagnosed similarly or dissimilarly by two different psychiatrists

Diagnosis of 2nd psychiatrist (P.2)	Diagnosis of 1st psychiatrist (P.1)										Total
	Anxiety state	Depression	Elation	Hysteria	Fatigue	Obsessional	Organic—acute	Organic—chronic	Schizophrenia	Lack of confidence	
Anxiety state ..	**346**	13	0	12	3	1	0	0	1	13	389
Depression ..	14	**34**	0	3	0	0	0	0	0	0	51
Elation	0	0	**0**	0	0	0	0	0	0	0	0
Hysteria	17	1	0	**32**	0	0	0	0	0	1	51
Fatigue syndrome	5	0	0	0	**10**	0	0	0	0	0	15
Obsessional ..	2	1	0	0	0	**4**	0	0	0	0	7
Organic—acute ..	0	0	0	0	0	0	**0**	0	0	0	0
Organic—chronic	0	0	0	0	0	0	0	**0**	0	0	0
Schizophrenia ..	0	0	0	0	0	0	0	0	**0**	0	0
Lack of confidence	13	1	0	2	0	0	0	0	0	**12**	28
Total ..	397	50	0	49	13	5	0	0	1	26	**541**

Note.—In this and all other similar tables the opinion of the first psychiatrist to see the case (P.1) is shown in the horizontal marginal total. The opinion of the second psychiatrist (P.2) is shown in the vertical marginal total. The number of times P.1 and P.2 agreed absolutely upon any one opinion is given in heavy type. All other figures in the body of the tables show wherein the disagreement lay.

In total it will be seen that the judgments of the two psychiatrists coincide in 438 of the 541 cases, or in 81 per cent, and differ in the remaining 19 per cent. It is of some importance to note that this amount of discrepancy can occur although the total numbers of cases of each reaction type recorded by each psychiatrist for the population as a whole are remarkably similar. For example, of the total 541 cases, P.1 diagnosed 397 as an anxiety state and P.2 diagnosed 389 similarly. P.1 diagnosed 50 as depression and P.2 found 51 ; P.1 regarded 26 as lack of confidence and P.2 found 28 such cases. It is clear, however, from study of the body of the table that this agreement in the marginal totals has occurred despite quite frequent disagreements over the individual case.

In considering the amount of agreement under the separate diagnostic headings, two figures, not necessarily identical, are available, namely, how often P.2 confirmed the previous assessment of P.1 and how often the opinion of P.2 had previously been reached by P.1. For instance, P.1 diagnosed 5 cases as obsessional and P.2 agreed in 4 or 80 per cent of them. On the other hand, P.2 diagnosed 7 as obsessional and P.1 had reached this conclusion in only 4 of them or 57 per cent. There is no logical reason for adopting one percentage rather than the other as the measure of agreement for we do not know which judgment, if either, was the correct one. The best measure of agreement is the mean of these two percentages weighted by the number of relevant observations made by P.1 and P.2. When a diagnosis has been given by P.1 or P.2 the mean agreement shows how often the associated diagnosis was the same. For example, in the obsessional group, P.1 made the diagnosis 5 times and P.2 7 times, and P.1 and P.2 agreed in 4 of the cases. Agreement of P.2 with P.1 is 4/5, 80 per cent, but agreement of P.1 with P.2 only 4/7, 57 per cent. The measure of total agreement is 5 times 80 plus 7 times 57, divided by 12, which is the total number of diagnoses of obsessional. This gives a mean rate of agreement of 66·7 per cent (*see* Table II).

TABLE II

Reaction types : the amount of agreement shown by two different psychiatrists under the main diagnostic headings

Diagnosis	No. of cases given by P.1	Percentage of P.1's cases with which P.2 agreed	No. of cases given by P.2	Percentage of P.2's cases with which P.1 agreed	Mean rate of agreement percentage	Mean rate of disagreement percentage
Anxiety state ..	397	87·2	389	88·9	88·1	11·9
Depression ..	50	68·0	51	66·7	67·3	32·7
Hysteria ..	49	65·3	51	62·7	64·0	36·0
Fatigue syndrome	13	76·9	15	66·7	71·4	28·6
Obsessional ..	5	80·0	7	57·1	66·7	33·3
Lack of confidence	26	46·1	28	42·9	44·4	55·6

Table II shows that when one or other psychiatrist made the commonest diagnosis, anxiety state, the other agreed with him in 88 per cent of the cases. When one or other concluded that the case was one of depression, hysteria, fatigue or obsessional neurosis the other agreed on, broadly, two-thirds of the cases. When one or other psychiatrist could find no evidence of disorder and judged the case to be one of lack of confidence the other agreed in but 44 per cent of instances.

In considering this last poor rate of agreement the limitation in the data, previously referred to, must be particularly remembered, but there are other serious difficulties in agreeing upon this particular diagnosis. On the average less than a third of the cases referred to a station medical officer as lacking in confidence are submitted for the psychiatrist's opinion, and the latter is consequently dealing only with those which present the greatest difficulties in diagnosis. Furthermore, it is impossible to make a sharp distinction between normal fear and abnormal fear, especially when the abnormal fear state (called an anxiety state) arises as in these subjects from normal fear (Symonds 1943). In the less well defined anxiety states when manifest fear of flying is not only the cause of the disorder but is apparent to the subject and the examiner, it becomes a matter of arbitrary opinion whether the label which is given to the disability is anxiety state (abnormal fear) or lack of confidence (fear). In fact, the distinction between the two may be considered artificial from a medical point of view, since it was made in the first place by the Executive as a matter of military expediency, with the realisation that moral as well as medical factors had to be considered. The psychiatrist had always realised that a distinction of this sort had to be made somewhere but he would be hard put to decide exactly upon what criteria the distinction should depend. Thus, although the psychiatrists agreed in the diagnosis of lack of confidence in only 44 per cent of cases, in 86·7 per cent of these cases in which there was disagreement, one psychiatrist made the diagnosis lack of confidence and the other anxiety state (Table III). There was consequently failure to maintain an exact distinction between normal and abnormal fear. The Executive Branch, recognising the slight shades of difference which are involved in this distinction, base the disposal of the two groups mainly upon the man's previous endeavour and achievement rather than upon the diagnosis.

While such difficulties in diagnosis may well account for the observed discrepancies they do not, of course, alter those discrepancies. The fact remains that when one or other psychiatrist thought a recognisable psychological disorder was not present and marked the case lack of confidence the other believed that it was present in at least half the cases.

Having shown how much agreement and disagreement there was between the two psychiatrists in making a diagnosis, it would be well to discover in what way they disagreed. The alternative diagnoses given when disagreement existed are shown in Table III. For instance, when one psychiatrist made the diagnosis of anxiety state, the other made one of the remaining diagnoses. As shown in the first column, one psychiatrist made the diagnosis of anxiety state in 94 cases, but the other made the diagnosis of hysteria in 31 per cent, depression in 29 per cent and lack of confidence in 28 per cent, and in the remaining 12 per cent fatigue, obsessional and schizophrenia.

TABLE III

Reaction types: the alternative diagnoses when disagreement existed between the two psychiatrists

Diagnosis given by the other psychiatrist	Diagnosis given by one psychiatrist with the percentage of alternative diagnoses given by the other				
	Anxiety state (94 cases)	Depression (33 cases)	Hysteria (36 cases)	Fatigue syndrome (8 cases)	Lack of confidence (30 cases)
Anxiety state ..	—	81·8	80·6	100·0	86·7
Depression ..	28·7	—	11·1	0·0	3·3
Hysteria ..	30·8	12·1	—	0·0	10·0
Fatigue syndrome	8·5	0·0	0·0	—	0·0
Obsessional ..	3·2	3·0	0·0	0·0	0·0
Schizophrenia ..	1·1	0·0	0·0	0·0	0·0
Lack of confidence	27·7	3·0	8·3	0·0	—

Table III shows that diagnoses of anxiety state by one psychiatrist are, in cases of disagreement, fairly evenly distributed by the other to depression, hysteria and lack of confidence. Diagnoses of depression, hysteria and fatigue are usually regarded as anxiety on the alternative assessment. It may be noted from Table I that there was no disagreement upon the absence of acute or chronic disorders of organic origin. Agreement upon the absence of a disorder has the same value as agreement upon its presence.

(*b*) *Causes.*—The psychiatrists were asked to define the main causes under the following headings: psychological, physical injury, physical illness, air-sickness, cold, altitude and exhaustion. Psychological causes were recognised in virtually every case by both psychiatrists, so that there was naturally nearly a 100 per cent agreement. There was also absolute agreement in rejecting cold and altitude as causal in any case. Airsickness and exhaustion were only blamed in 2 per cent, and physical injury and illness in about 10 per cent of the cases. So little data were therefore available upon these opinions that the agreement was not tested.

(*c*) *The responsibility of flying duties.*—The cards contained an unqualified statement as to whether or not the neurosis had been caused mainly by flying duties. The agreement of the two psychiatrists' opinions on this point is shown in Table IV. In the majority of cases, 411, or 76 per cent, P.1 and P.2 both considered that flying duties had been a contributory factor.

TABLE IV

Whether or not neurosis had been caused mainly by flying duties

Opinion given by other psychiatrist (P.2)	Opinion given by one psychiatrist (P.1)		
	Yes	No	Total
Yes	411	46	457
No	37	47	84
Total ..	448	93	541

In a further 47, or 8·7 per cent, they agreed that they had not played a part, giving a total agreement rate of 84·7 per cent and disagreement in the remaining 15·3 per cent. When both psychiatrists give a great preponderance of positive answers the agreement in the 'Yes' group is, naturally, bound to be high and the disagreements are, therefore, mainly derived from the cases in which one or other psychiatrist had concluded that flying duties had not been causal. Of the 93 cases in which P.1 believed flying duties had not been a factor, P.2 disagreed in half, and of the 84 in which P.2 thought flying duties had not been a factor P.1 had reached a reverse conclusion in 44 per cent. In other words when one or other psychiatrist had reached the conclusion that flying duties were not causal there was only an approximately even chance that the second opinion would be similar. This discrepancy is a reflection of the great difficulty in deciding, when other causal factors are known to be present, whether the experiences of flying which have contributed to the illness are of major importance. This difficulty was particularly great in men who broke down before flying at all, where the opinion might be held that anticipation of the job in hand had or had not contributed to the illness.

(*d*) *Flying stress.*—The psychiatrists making these returns had been instructed to assess the psychological stress the patient had encountered in flying, whatever the nature of his duty, and to classify it in five degrees from nil to exceptional. As the assessment of exceptional stress was made only on seven occasions this grade has been included under severe. No definition of these degrees was laid down and the observer had to make his assessments in terms of what he would regard as an average experience for any duty. The figures of the resulting opinions of the two psychiatrists are given in Table V.

TABLE V

Classification of degree of flying stress encountered in flying by two different psychiatrists

Opinion given by other psychiatrist (P.2)	Opinion given by one psychiatrist (P.1)				
	Nil	Slight	Moderate	Severe	Total
Nil	**140**	33	9	1	183
Slight	29	**76**	20	10	135
Moderate	9	33	**72**	21	135
Severe	1	12	35	**40**	88
Total	179	154	136	72	541

It will be seen that there is fairly close agreement between P.1 and P.2 in the distribution of the degrees of stress in the population as a whole, as shown in the marginal totals, but again agreement over individuals, in the body of the table, is not so close. The extent to which agreement existed is given in percentage form in Tables VI (a) and (b) which show how often P.1's opinion was subsequently confirmed by P.2, and also how often P.2's opinion had been previously reached by P.1.

TABLE VI(a)

Percentage number of cases in which two different psychiatrists agreed and disagreed in their opinions

(Derived from Table V)

Opinion given by 2nd psychiatrist (P.2)	Opinion given by 1st psychiatrist (P.1)			
	Nil (179 cases)	Slight (154 cases)	Moderate (136 cases)	Severe (72 cases)
Nil	**78·2**	21·4	6·6	1·4
Slight	16·2	**49·4**	14·7	13·9
Moderate	5·0	21·4	**52·9**	29·2
Severe	0·6	7·8	25·7	**55·6**
Total	100·0	100·0	99·9	100·1

TABLE VI(b)

Opinion given by 1st psychiatrist (P.1)	Opinion given by 2nd psychiatrist (P.2)			
	Nil (183 cases)	Slight (135 cases)	Moderate (135 cases)	Severe (88 cases)
Nil	**76·5**	21·5	6·7	1·1
Slight	18·0	**56·3**	24·4	13·6
Moderate	4·9	14·8	**53·3**	39·8
Severe	0·5	7·4	15·6	**45·5**
Total	99·9	100·0	100·0	100·0

It will be seen that the same answer is usually reached in comparing P.1 with P.2 (Table VI(*a*)) or P.2 with P.1 (Table VI(*b*)). The conclusions derived from them are as follows. If one or other psychiatrist thought that no flying stress at all had been experienced by the patient the other agreed with him in rather more than three-quarters of the cases and regarded it at least as only slight in another 16–18 per cent. On the other hand, serious disagreements (of more than one degree) are apparent in five per cent of the cases—nil in the judgment of one and moderate or, very occasionally, severe in the judgment of the other.

If the stress was judged to be *slight* by one or other psychiatrist there was exact agreement in approximately half, and in another 21 per cent the second opinion was only nil rather than slight. On the other hand, seven to eight per cent of the cases considered slight in one judgment were regarded as severe in the other—a difference of more than one degree.

With those cases where the stress was judged to have been *moderate* there was again exact agreement in some 50 per cent but nearly seven per cent were regarded as having had no stress at all in the second opinion.

Where stress was judged severe there was also exact agreement in roughly half the cases, but the second opinion considered nearly 14 per cent as slight only and one per cent even as nil—a total of 15 per cent marked discrepancies.

If in the table as a whole we consider a difference of more than one degree as denoting a serious discrepancy between assessments, then we find that there were 42 such divergences or 7·8 per cent of the total 541 cases. (This figure is the same whether we take P.1 to P.2 or P.2 to P.1.)

(*e*) *Non-flying stress.*—The degree of psychological stress which had been experienced apart from flying, referred to as non-flying stress, was assessed by the psychiatrists in three grades—nil, mild and severe—for which no definitions were laid down. The agreement reached upon this three-point assessment is shown in Table VII. The data show exact agreement between judgments in 78 per cent of the assessments—the majority indicating no such stress. The most marked difference in opinion lies in the severe category, for P.1 regarded 20 men as having had severe non-flying stress and P.2 agreed with him in 11 cases (55 per cent), but regarded five as having had mild stress and four as having had none at all. This discrepancy is less when viewed in the reverse direction for of the 14 assessed as severe by P.2, P.1 had similarly judged 11 (79 per cent).

If nil or mild in one judgment and severe in the other is taken as being a serious difference of opinion, the table as a whole gives 12 such cases, representing 2·2 per cent of the observations.

TABLE VII

Degree of non-flying stress experienced in the opinion of two different psychiatrists

Opinion given by other psychiatrist (P.2)	Opinion given by one psychiatrist (P.1)			
	Nil	Mild	Severe	Total
Nil	**315**	63	4	382
Mild	43	**97**	5	145
Severe	1	2	**11**	14
Total	359	162	20	541

(*f*) *Predisposition to neurosis.*—Finally there is what is probably the most important problem of assessment, that of predisposition to neurosis. It is based upon the man's life story up to the time of assuming aircrew duties, and upon the total impression obtained at an interview lasting for an hour. The predisposition was assessed in one of three grades—nil, mild, severe—and the relevant figures are given in Table VIII. Exact agreement was reached as to the degree of predisposition assessed on this three-point scale in 322 instances, or 59·5 per cent of the total. It will be noted from Table VIII that the distribution of the assessments in the total population also show an appreciable difference, for P.1 regarded 135 of the men as having no predisposition and 97 as being severely predisposed, while P.2 considered only 116 to have no predisposition and as many as 125 as being severely predisposed.

TABLE VIII

Degree of predisposition to neurosis in the opinion of two different psychiatrists

Opinion given by 2nd psychiatrist (P.2)	Opinion given by 1st psychiatrist (P.1)			
	Nil	Mild	Severe	Total
Nil	**61**	51	4	116
Mild	64	**202**	34	300
Severe	10	56	**59**	125
Total	135	309	97	541

TABLE IX

Degree of predisposition to neurosis: the percentage of agreements and disagreements between two different psychiatrists

Opinion given by other psychiatrist (P.2)	Opinion given by one psychiatrist (P.1)		
	Nil	Mild	Severe
Nil	**48·6**	18·9	6·3
Mild	45·8	**66·3**	40·5
Severe	5·6	14·8	**53·2**
Total	100·0	100·0	100·0

The percentage rates of agreement and disagreement to which these figures lead are given in Table IX. They are the weighted mean rates of the proportions in which P.2 confirmed P.1's opinion and in which P.1 had previously reached P.2's assessment calculated as described on page 311 and as shown in Table II.

These figures of Table IX lead to the following conclusions :—

(i) When one or other psychiatrist had assessed a man as having *no predisposition* to neurosis, the second psychiatrist agreed exactly with this opinion in just under half the cases (48·6 per cent). The great majority of the remainder were regarded by the second psychiatrist as having only a mild degree of predisposition. In 5·6 per cent, however, the second psychiatrist concluded that a case marked nil by his colleague had a severe degree of predisposition.

(ii) When one or other psychiatrist had assessed a man as having a *mild predisposition* to neurosis, the second psychiatrist agreed with this opinion in two-thirds of the cases. In 18·9 per cent he could detect no predisposition at all and in the remaining 14·8 per cent he regarded the degree as severe rather than mild.

(iii) When one or other psychiatrist had assessed a man as having a *severe predisposition* to neurosis, the second psychiatrist agreed exactly with his opinion in just over half the cases. In the great majority of the remainder he would regard the degree of predisposition as mild rather than severe, but in 6·3 per cent of the cases marked severe by his colleague he could detect no predisposition at all.

Returning to Table VIII, it may be held that differences between mild or no predisposition are relatively unimportant and that the crucial agreement then is upon whether a man is so predisposed that he should have been rejected for aircrew on the evidence available. Of the 97 so regarded by P.1, P.2 would disagree in 38 cases, or 39 per cent., while of the 125 judged severe by P.2, P.1 disagreed in 66 cases, or 53 per cent. In other words, in this particular field of observation nearly half the assessments of severe predisposition made by one psychiatrist were not confirmed by another psychiatrist, though in 87 per cent. of the disagreements the other psychiatrist recognised some signs of predisposition which led to the assessment mild.

The circumstances in which the two psychiatrists work must be considered in appraising this result. The first psychiatrist is almost invariably working at a centre near the squadron to which the patient is referred by the station or squadron medical officer. As a rule this psychiatrist has referred these cases to hospital for further investigation and treatment, or to the Central Medical Establishment for further investigation and disposal. He himself is much more preoccupied with the immediate handling of the patient than with his ultimate disposal. In these cases which he is referring elsewhere he is less likely to tax the patient with a detailed analysis of his past and he may fail to elicit points revealed by the second observer, which, had he known them, he would have considered important in assessing predisposition. Indeed, the first psychiatrist may feel it undesirable as well as unimportant to push the matter at that stage. The second observer is bound to do so in order to ascertain the best disposal, which is based mainly upon an assessment of predisposition to neurosis, and he usually also has greater opportunity for doing so. The results in Table VIII support these observations since they show that the second psychiatrist has in fact elicited more evidence of predisposition than has the first. As was pointed out early in this report, such limitations of the enquiry suggest that it is undesirable to transfer the present results without reservation to the sphere of selection of aircrew at entry.

3. Conclusion

In the previous sections we have shown in detail the amount of agreement which the psychiatrists have revealed in assessing the characteristics of cases of psychological disorder, and we have dealt with each of those characteristics in turn. An obvious question then is: What is the overall result? Is the general standard of agreement good, bad, or indifferent? The answer to that question must depend partly upon the universe of discourse, i.e. the particular problem at issue. If the object of collecting such psychiatric data is to get a broad picture of the characteristics of different populations, such as different members of aircrew or the same population at different periods of time, then, on the whole, we should regard the amount of agreement as sufficiently close to lead to some useful results. For instance, in assessing the importance of flying stress as a factor in psychological disorder the psychiatrists quite frequently show relatively slight differences of opinion and occasionally serious differences. It would, however, be reasonable to use such judgments to see whether the distribution of this characteristic differed widely between one large group and another or between one time and another.

A parallel situation can be found in the study of the certified causes of death. Some degree of error is inherent in all such material, varying from one cause to another, but it is possible nevertheless to make, with due caution, illuminating studies of changes in the death rates in time or between specific occupational groups. With similar caution and attention to particular circumstances, e.g. changing standards in time, it seems that corresponding comparisons can be of value in the present field of study. Further, with the causes of death, attention must be focussed upon each particular cause under study and the probable amount and type of error assessed ; no overall degree of accuracy can be applied. Similarly here we cannot give a general rate of agreement. Our results show that in some characteristics there is a greater degree of concordance than in others and those differences must be borne in mind in the interpretation of results.

If the universe of discourse is not the characteristics of a population—subject to error but still of value in giving the broad picture—but is the characteristics of the individual, then we are on much less secure ground. Even ignoring the slighter discrepancies, we have still a modicum of disturbing disagreements which may, for the individual, have far-reaching results, e.g. the connotation lack of confidence or the assessment of a severe degree of predisposition. We make no attempt to minimise these disagreements. With regard to the former we conclude that while with some cases there may be no serious difficulty in reaching a clear-cut conclusion, in others there can, from the medical aspect, be no certain dividing line between *normal* and *abnormal fear*.

With regard to predisposition the psychiatrist's aid may well be sought in the selection of aircrew at entry. We have pointed out that we do not think the present results can be legitimately transferred to that field since these assessments were made after breakdown had occurred and not in anticipation of it. The degree of concordance in judgments in a " normal " population might well differ from that found in this " abnormal " group. At best, however, these subjective evaluations of the personality present problems of great complexity and, as E. S. James (1944) has pointed out, are capable of many interpretations. In practice, the rejection of an unsuitable man will, however, depend upon the considered opinion of a medical board, or, if he is considered medically fit, of a board of executive officers who may use the opinion of the psychiatrist as well as the findings of psychologists, in assessing the candidate's temperamental suitability. Thus either the medical or the executive board may use the psychiatrist's opinion to enlarge the premises upon which their judgment is based. In such a setting differences of psychiatric opinion may still play a part in the final decision, but they will play a less dominating role—and such differences in the appraisal of personalities are, it should be noted, not the sole prerogative of the psychiatrist but affect all who are concerned with selection.

Returning then to the question at the beginning of this section—Is the standard of agreement of psychiatric opinion good, bad, or indifferent ?—we should, in short, say that the answer depends upon the particular circumstances under which the observations are made, the particular characteristics under study, and the particular purposes for which they are being applied. The present observations, though limited to a circumscribed field, namely, cases of psychological disorder, at least give some numerical measure of those differences of opinion which it was obvious must occur in so difficult a field of judgment. They may therefore aid in the interpretation of results in that field.

4.

Summary

(1) Under a system in use in the Royal Air Force a specially designed card is completed by neuro-psychiatrists for every member of air crew referred to them with suspicion of a neurosis. The information thus provided includes the psychiatrist's conclusions upon the following points: The reaction type of the illness; its main causes and their relationship to the man's flying duties; the degree of psychological stress to which the man has been exposed in flying; the degree of stress to which he has been exposed apart from flying; and the extent to which he is predisposed to neurosis.

(2) In nearly two years just over 5,000 such cards were returned, and in 541 of these cases it was found that the same man had been seen at different times and in a different place by two different psychiatrists. These duplicate returns offered a means of determining the degree to which any two psychiatrists using similar methods of interview agreed in their judgments on the points listed above.

(3) This scale of agreement is being measured, it should be noted, not in an unselected population but in a group almost entirely composed of cases of psychological disorder. To some extent it will probably comprise the more difficult of those cases.

(4) The reaction type of the disorder was diagnosed under 9 headings. In 81 per cent of the cases the two psychiatrists agreed in their diagnosis, in 19 per cent they disagreed. Study of the specific diagnoses shows that the psychiatrists agreed in nearly 90 per cent of cases with the commonest diagnosis—namely, anxiety state—and in approximately two-thirds of the cases diagnosed as either depression, hysteria, fatigue or obsessional neurosis. They agreed in the complete absence of acute and chronic organic disorder. When one psychiatrist could find no evidence of neurosis and judged the case to be one of lack of confidence, the other agreed in only half the cases. This disagreement is discussed in the light of the difficulty of deciding in borderline cases where normal fear (lack of confidence) ends, and abnormal fear (an anxiety state) begins. The great majority of these cases, regarded as *fear* by one examiner, were regarded as an anxiety state, or *abnormal fear* by the other. Disagreement upon this particular distinction, which is fundamentally artificial, was to have been expected.

(5) In 76 per cent of the cases both psychiatrists considered that *flying duties had been a factor* in the psychological disorder. In 9 per cent both considered that it had played no part, giving a total agreement rate of 85 per cent and disagreement in the remaining 15 per cent.

(6) In assessing on a four-point scale the amount of *flying stress* experienced the psychiatrists agreed exactly in 61 per cent of cases. They differed by more than one place in their assessments in 8 per cent of the cases.

(7) In their assessment on a three-point scale of the degree of *other stresses* to which the patient had been exposed the psychiatrists agreed exactly in 78 per cent. They differed seriously in 2 per cent.

(8) In their assessment of the patients' predisposition to neurosis upon a three-point scale the psychiatrists were in exact agreement in 60 per cent of the cases. Nearly half the assessments of severe predisposition made by one psychiatrist were not confirmed by the other, though in the great majority of such cases the second psychiatrist recognised some signs of predisposition, regarding them as mild rather than severe. In 6 per cent of the cases that had in the opinion of one psychiatrist a severe degree of predisposition the other psychiatrist could detect no evidence of any predisposition.

(9) The limitations of the results of the enquiry and particularly of those relating to predisposition are described, with a comment upon the inadvisability of transferring the conclusions directly to the problem of selection of air crews.

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CHAPTER XXIII

FLUCTUATIONS IN NAVIGATOR PERFORMANCE DURING OPERATIONAL SORTIES

by

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FPRC Report 615, April, 1945

Introduction

Interest has been recently focussed on the various factors likely to affect the level of crew efficiency under operational conditions. Tactical considerations, such as the need in bomber operations for precise timing and track-keeping demand the minimum of human error. Laboratory experiments have strongly suggested the importance of prolonged mental concentration as a cause of deterioration in performance. The results suggest that the effect of fatigue will be evident in a fall in the level of efficiency towards the end of a long period of mental effort. In bomber operations, however, study of special features of combat performance such as bombing accuracy has shown inconsistencies which cannot be explained by the mechanical effects of heights or evasive manoeuvre, or by the effects of fatigue on crew personnel. Such instances also occur during training, where navigators can pass a speeded-up synthetic exercise yet fail on a flying exercise conducted at relatively reduced speed. Where no adequate physical explanation is feasible, the effects of such intangibles as anxiety and emotional upset must be examined. This paper describes an attempt to interpret the fluctuations in performance during operational sorties in the light of the possible influence of such psychological factors.

It is at once apparent that the main difficulty in making an accurate analysis of operational performance is the absence of an adequate measure of the quality of that performance at various points during a sortie. Certainly there exists no gauge of overall skill which can be applied to the material available from combat records. Until such a gauge materialises, it must suffice to assess from the analysis of one facet of the overall performance, the fluctuations in efficiency from time to time during an operational sortie.

In this study, the facet of performance analysed was the calculation and plotting error involved in measuring wind vectors on the navigational charts used on operational sorties. This measure of performance has considerable advantages :—

(*a*) It is operationally important (in track-keeping and timing).

(*b*) The degree of error can be expressed numerically.

(*c*) This error is independent of such technical considerations as the reliability of radio fixes.

(*d*) Repeated assays of the error can be made throughout the sortie and allocated to definite times.

The practical details of the method are given in the R.A.F. Manual of Air Navigation, but for those unfamiliar with navigational technique a brief description follows.

Like all other vectors, the velocity and bearing of the wind may be represented as a line having length proportional to that velocity, and direction equal to that bearing. The basic navigational method of finding the windspeed

FIG. 1

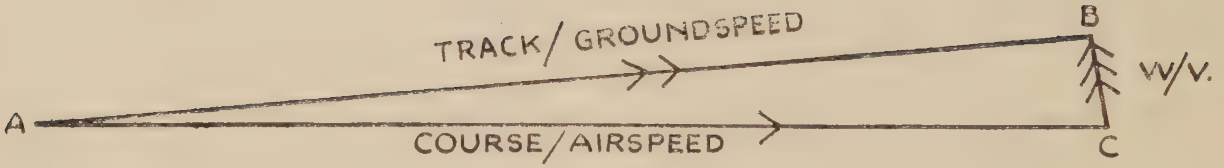
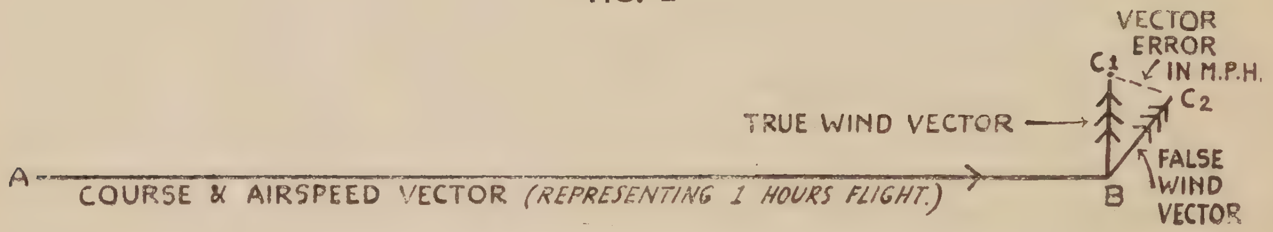


FIG. 2



Wind-finding by method of triangle of velocities and direction is by the application of the principle of the triangle of velocities (*see* Fig. 1). If, by accurate pin-pointing or other accurate method of fixing his ground position, the navigator knows that he has travelled from point A to point B in known time, the groundspeed and track can be calculated. The airspeed, course, and often the air position, are given by the instruments, and from these two vectors the triangle of velocities can be plotted, the third side of which is the vector representing the speed and direction of the wind. This process is, of course, open to the effects of human error in the arithmetic and simple geometry involved. The error in wind computation may occur in velocity and/or direction. The most satisfactory measure of the combined effect of these mistakes is the ' vector error ', expressed in m.p.h., between the wind found by the navigator and the ' true ' wind which he should have derived from the fixes and air positions which he has logged. This wind vector error in m.p.h. is actually equal to the error in miles after one hour's flight, of the aircraft's computed D.R. position based on the incorrect wind (*see* Fig. 2) where AB represents the course and airspeed vector after one hour's flight. BC is the ' true ' wind vector, *i.e.* the wind vector found from the fix and air position logged on the previous section of the route. (For the purposes of this investigation these are assumed to be correct.) BC is the wind vector incorrectly calculated by the navigator on the previous leg and used by him to derive the D.R. position on the present section. The true D.R. position is given by C_1, the incorrect position by C_2. The distance between them C_1 C_2, is the vector error in wind-finding in m.p.h. Since the time of flight is one hour, C_1 C_2 is also the error in miles of the computed D.R. position. It is this vector error which has been used in the analysis. The time and position at which these wind vector calculations were made is available in the log. In assessing the significance of the amount of error, it should be remembered that some error is inevitable owing to such instrumental difficulties as reading a protractor to within ½°. Errors above an arbitrary minimum can be fairly attributed to the human element. Indeed, the degree of navigator accuracy could alternatively be measured by noting the percentage of errors exceeding this permissible minimum.

1. Collection of data

An investigation into the standards of navigator performance was recently conducted by the Operational Research Section of Bomber Command (1). From the logs and charts of navigators engaged in a series of seven bombing raids, random samples were taken of the calculations involved in wind-finding at various points throughout the sortie. The errors, if any, made on each of these occasions were then expressed, as explained above, in terms of the resultant deviation in miles, of correct from incorrect deduced position. Up to six samples were taken from the log of each navigator in each sortie. Through the courtesy of the officers concerned, these results were made available for analysis.

2. Method of analysis of data

Clearly, sorties to different targets involve journeys under varying conditions of duration, enemy action and weather. The same psychological factors can as a first step reasonably be assumed to operate at similar stages of different sorties, *e.g.* approaching the target or on the last part of the way home. Any variations in navigator error which occur fairly consistently under similar circumstances may then be open to a psychological interpretation. All the routes taken by the main force to the targets on the seven raids were known. One typical example is shown in Fig. 3. These routes were then arbitrarily divided into sections according to the following convention :—

(*a*) *Base* .. .. From base until the crossing of the line of longitude before the enemy coast.
(*b*) *Enemy coast* .. Between the two lines of longitude on either side of the enemy coastline.
(*c*) *Approach to target* From the line of longitude on the landward side of the coast, to the target.
(*d*) *After the target* .. From the target area to the line of longitude before the enemy coast.
(*e*) *Enemy coast* (*R*) Between the two lines of longitude on either side of the enemy coast.
(*f*) *Base* (*R*) .. From the seaward of these two lines to base.

Once the routes for the seven raids had been thus divided, the errors occurring at positions within these limits were summed, and the mean and standard deviation calculated. The results are shown in Table I, where the means are given for each stage in each operation. Unfortunately the numbers upon which these observations are based vary considerably but the main trend is obvious in the grand means at the bottom of the table. These show that there is a progressive rise in the mean error from base to target. After the target, the mean error falls, then rises over the enemy coast before falling again on the last stage of the journey to home base. (The significance of these differences may be gauged from the standard errors of the means given in Table I).

TABLE I

Mean errors in successive stages in sorties

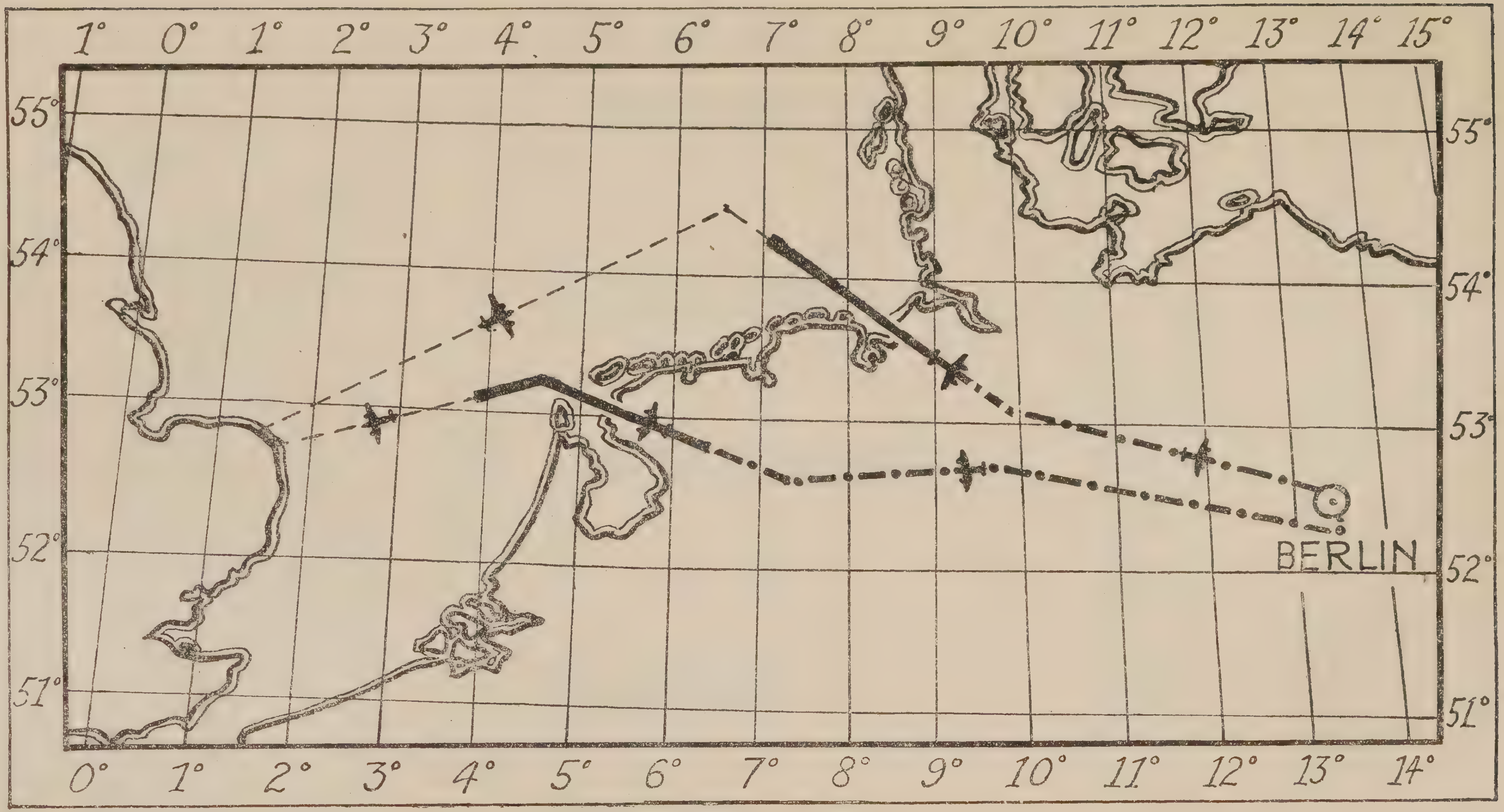
Objective	Base (O)	Enemy coast (O)	Approach to target	After target	Enemy coast (R)	Base (R)
Magdeburg ..	4·45 (29)	3·30 (24)	2·95 (21)	**4·46** (13)	**5·62** (18)	5·50 (11)
Stuttgart (1) ..	0·00 (3)	1·20 (5)	2·17 (12)	**4·67** (6)	6·00 (2)	— (0)
Stuttgart (2) ..	1·20 (5)	2·00 (15)	**2·79** (38)	**3·52** (32)	5·50 (2)	— (0)
Frankfurt (1) ..	0·25 (2)	1·70 (14)	**3·58** (38)	**3·76** (27)	**4·93** (14)	1·50 (1)
Frankfurt (2) ..	0·17 (3)*	5·32 (17)	**3·81** (16)	**3·33** (26)	1·31 (16)	5·25 (2)*
Berlin	2·53 (19)*	3·90 (50)	**7·86** (56)	**3·96** (45)	2·22 (9)	4·00 (4)*
Dusseldorf ..	2·36 (66)*	2·90 (36)	**7·15** (32)	**4·07** (7)	7·59 (23)	3·14 (33)*
All objectives	2·67±·43	3·29±·33	4·90±·48	3·80±·42	4·86±·91	3·75±1·00

This result is compared in Fig. 4 with a graph of the variation in speed of respiration in an experienced bomber pilot during an operational sortie (Goldie 1942). The obvious association between variations in performance and

(i) * Indicates the raids on which mean error tended to be at maximum before target was reached.
(ii) Numbers of observations upon which means are based are enclosed in brackets.
(iii) Sections of route where losses occurred are indicated by heavy type.

FIG, 3

SECTIONS OF ROUTE OF SORTIE



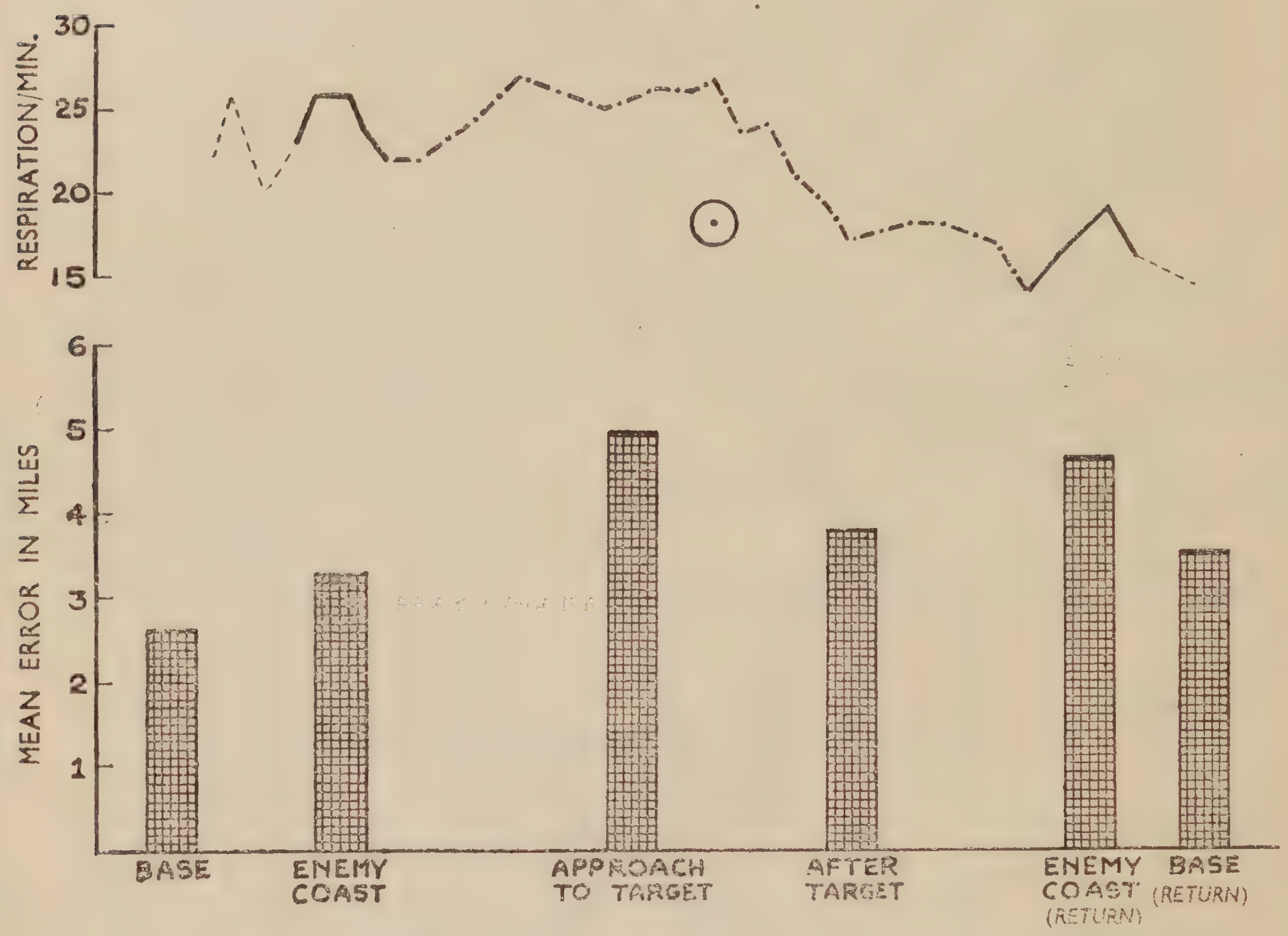
BETWEEN BASE AND ENEMY COAST

ENEMY COAST

BETWEEN ENEMY COAST AND TARGET

respiratory rhythm is presumably due to some common factor affecting them both. Emotional tension may be that common factor, since the diminished efficiency of navigational aids beyond the enemy coast should, other things being equal, impress on the navigator the need for accuracy of log and chart work. It may be further presumed that such tension is increased in the presence of enemy opposition. Inspection of the detail of Table I shows that the trend evident in the grand means is not consistent in each individual operation. This is in part due to the difference between the numbers of observations upon which the means are based, which introduce chance errors, but there

FIG. 4



MEAN ERROR AT SUCCESSIVE STAGES COMPARED WITH RESPIRATION RATES

is also a clear tendency in three of the raids (marked in the table by an asterisk), for the mean error to be at a maximum before the target is reached. In the remainder, the mean error tends to be at a maximum in the latter part of the sortie. This divergence accounts for the bimodal nature of the curve of grand means. To test the suggestion that some psychological reaction to enemy opposition was the basis of this phenomenon, the combat reports for these seven raids were examined. The numbers of aircraft lost to the enemy defences, fighter or flak, were counted for each section of the route. The sections of the routes on each of the raids where the opposition was fierce enough to cause losses are in heavy type in Table I. Broadly speaking, it may be said that—

> Interception of the bomber stream may take place either before the target is reached, or on the way home.

> Opposition is generally associated with a rise in the mean error in navigator calculation.

This last conclusion is at best a crude generalisation, as it is unlikely that the reaction to opposition is the only factor affecting navigator performance. The data may be further analysed by division into observations made—

(i) before effective opposition was met;

(ii) during *intensive* opposition;

(iii) during the section of the route immediately after (ii) (if this lay over enemy territory);

(iv) the last section of the journey home.

For comparison, a similar analysis was made of navigators' errors occurring during a series of night cross-country training flights under quasi-operational conditions. The navigators concerned were fully trained personnel who were awaiting posting to operational squadrons. The flights lasted about five hours and samples were taken of the calculations made at intervals throughout the flight.

The results of these analyses are summarised in Table II.

TABLE II

Mean Errors at Successive Stages on (*a*) Operational and (*b*) Non-operational Flights

(*a*) Operational	Before	During opposition	After	Return to base
(1) No. of observations ..	252	442	49	48
(2) Mean error in miles (m) ..	2·77 ± ·28	4·51 ± ·30	4·87 ± 1·17	3·75 ± 1·20
(3) S.D. of error distribution (σ) ..	4·37	6·38	8·18	8·34
(4) Coefficient of variation $\left(\frac{100\,\sigma}{m}\right)$	157·8	141·15	167·9	222·4
(5) Percentage of errors over 4 miles	22·6	36·4	44·9	18·8
(*b*) Non-operational	1st hour	2nd hour	3rd hour	4th hour
(1) No. of observations ..	172	172	172	172
(2) Mean error in miles (m) ..	1·33 ± ·38	1·13 ± ·16	1·89 ± ·18	0·90 ± ·12
(3) S.D.—error distribution (σ) ..	4·98	2·08	2·33	1·62
(4) Coefficient of variation $\left(\frac{100\,\sigma}{m}\right)$	374·4	184·1	213·8	180·8
(5) Percentage of errors over 4 miles	5·2	4·7	4·1	2·3

The data given in the second lines of both sections of Table II are compared in Figs. 5 and 6. The operational means are all significantly higher than the non-operational controls. Further, although the mean error in the non-operational series tends to fall slightly, the means rise abruptly in the periods during and immediately after the encountering of severe enemy opposition.

Comparison of the standard deviations of the error distributions given in the third lines of the two sections of Table II, shows some divergence between the downward trend of the non-operational values and the upward trend of the operational ones. When this comparison is made between the more accurate measures of dispersion round the means given by the Coefficient of Variation, the divergence is not so striking and interpretation of the significance of these changes in variability is difficult.

In the fifth lines of both sections are given the percentages of errors exceeding the maximum which might reasonably occur because of the limitations in accuracy of the instruments used (4 miles). The non-operational series shows a consistent downward trend, while in the operational group the percentage rises to a maximum during and after opposition. In the last stage of the operational flights the percentage falls considerably. These changes are significant ($X^2 = 17 \cdot 71$, $n = 3$, $P < \cdot 01$).

The position may be summarised by reviewing the trends of the means and standard deviations in the light of these percentages. In the non-operational series, the mean error decreases because fewer large mistakes are made in each successive hour. In the first three stages of the operational sorties, however, an increasing proportion of larger mistakes are made. In the last stage, a much smaller proportion of the mistakes are above the permissible limit.

One possible interpretation of the data may be offered. The standard of performance to be expected in fully trained navigators flying under conditions similar to those met on operational sortiés is seen in the second series of results. The two critical differences lie in the facts that :—

> The efficiency of the operational group might have been diminished by the accumulative effects of operational strain.
>
> There was no element of hazard due to enemy action in the non-operational series of flights.

The difference in general level and trend of the mean error and possibly also in variability of performance between the operational and non-operational series has already been noted. This difference cannot be attributed to external technical factors, as the errors measured were mistakes in calculation which were quite independent of the results obtained from the navigational aids. These errors must thus have arisen within the individuals themselves. Indeed, it is likely that they are the results of the emotional disturbance inseparable from the anxiety involved in action against the enemy. The rise in the mean error above the level usually found in normal flight even before action is joined suggests the influence on performance of anticipatory anxiety. Once opposition is met, the mean rises still further, presumably in the mental confusion engendered by such perturbing circumstances. It is interesting to note, too, that this inefficiency persists even after this stage of acute danger, as long as the aircraft is over enemy territory and liable to renewed attack. On the last part of the journey home, anxiety is at least in part allayed but fatigue might be expected to operate. In this context, fatigue may be defined as the effect of prolonged activity evident in a terminal deterioration of efficiency. It is difficult to disentangle the influence of anxiety and fatigue, particularly, as is often observed, anxiety per se will cause an early deterioration in skilled performance (Davis 1943). A distinction might be made between anxiety as a cause of distraction and anxiety as a factor in fatigue. The data in Table II suggests that as far as the bulk of the crews are concerned, the distractive effect of acute anxiety is more important than the effect of fatigue as measured by a terminal fall in efficiency. The data does suggest, however, that a small minority are still making unduly large errors when on the last lap of the journey. It gives no indication whether this is due to a real mental deterioration in an unduly fatiguable minority or merely to a slackening of navigational conscience and crew discipline.

If this interpretation of the facts is valid, then it may be useful in assessing the applicability of laboratory studies to operational conditions, and in the explanation of the inconsistencies of combat performance already noted. There is as yet no known method of eliciting in the laboratory the emotional responses evoked by action against the enemy. The importance of these responses in determining crew performance has been demonstrated. Laboratory studies of fatigue which show only a terminal deterioration in efficiency may well be applicable to the monotonous conditions of long range sea patrols. But in bomber operations, such a terminal deterioration due to fatigue would be masked by the effects of previous periods of acute anxiety. Although thus overshadowed, the results of fatigue may be none the less real. The difficulty of determining from operational data the optimum length of activity to avoid fatigue is obvious. Although the results are only suggestive, there is a hint that the effects, within a group, of prolonged mental effort may be more evident in an increased variability or raggedness of performance rather than in any terminal fall in the mean level of efficiency. This, of course, has often been shown in laboratory experiments.

This reading also suggests explanations of the inconsistencies of training and combat performance noted in the introduction. In training, discrepancies between ground and air performance are probably due to the increased emotional tension of flight. Errors in wind finding on the outward leg of an operational sortie, when fatigue could hardly be expected to operate, presumably arise from anticipatory anxiety. The increase in scatter of the bomb pattern over a heavily defended target reflects acute anxiety. The persistent effect of sustained apprehension was evident in the high mean error while still liable to attack over enemy territory. This effect may well explain the results obtained over targets when opposition en route had been anticipated, but not in fact met.

As far as selection of key personnel such as the 'wind finders' of a bomber formation is concerned, this study merely re-emphasises the importance of stability of performance under conditions of stress. A close analysis of their operational records will distinguish from among men of equal proficiency under normal circumstances, those who maintain their efficiency in the heat of action. To them should be assigned the post of unusual responsibility.

FIG. 5

Mean Errors Before, During and After Opposition on Operational Sorties

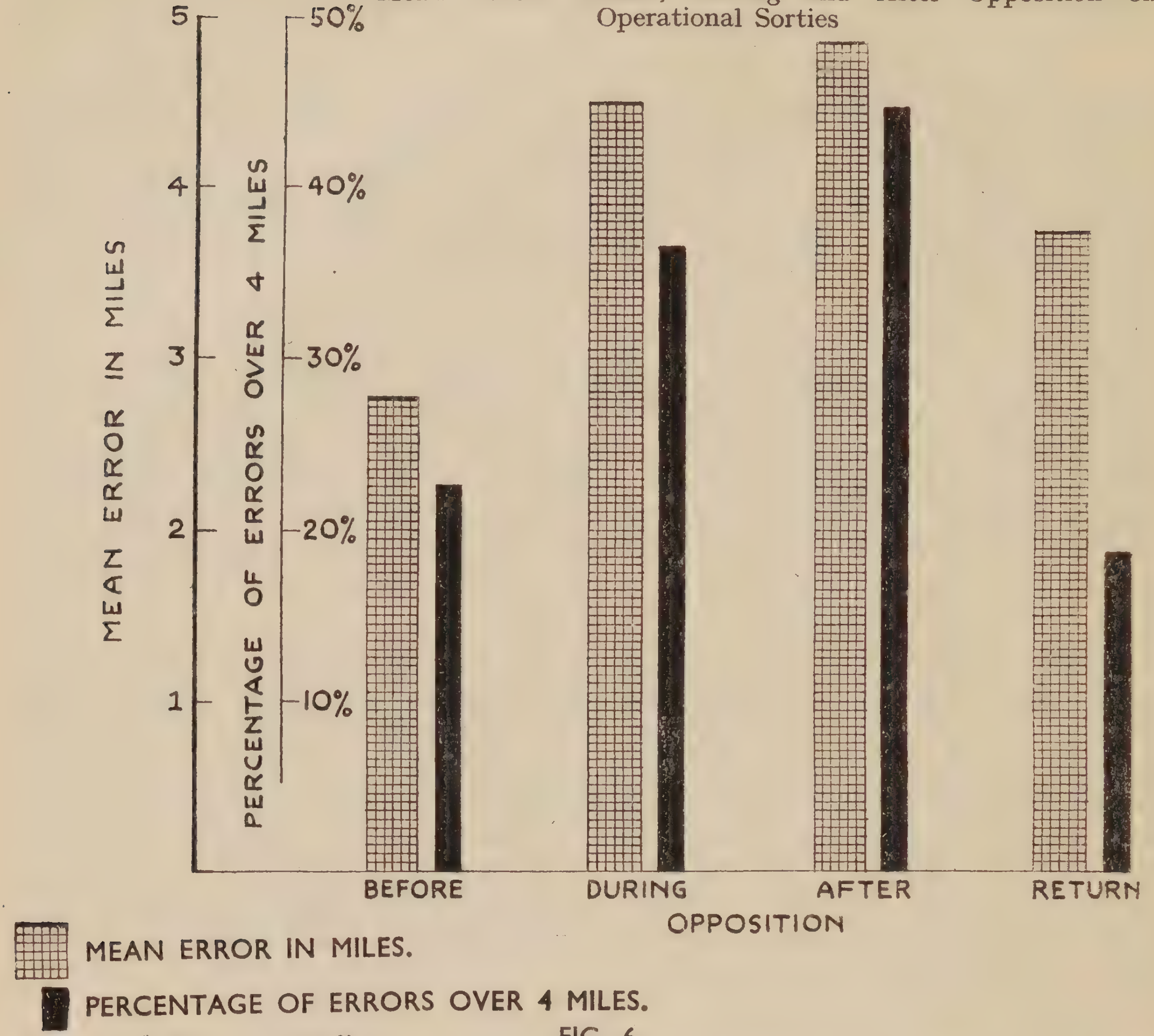
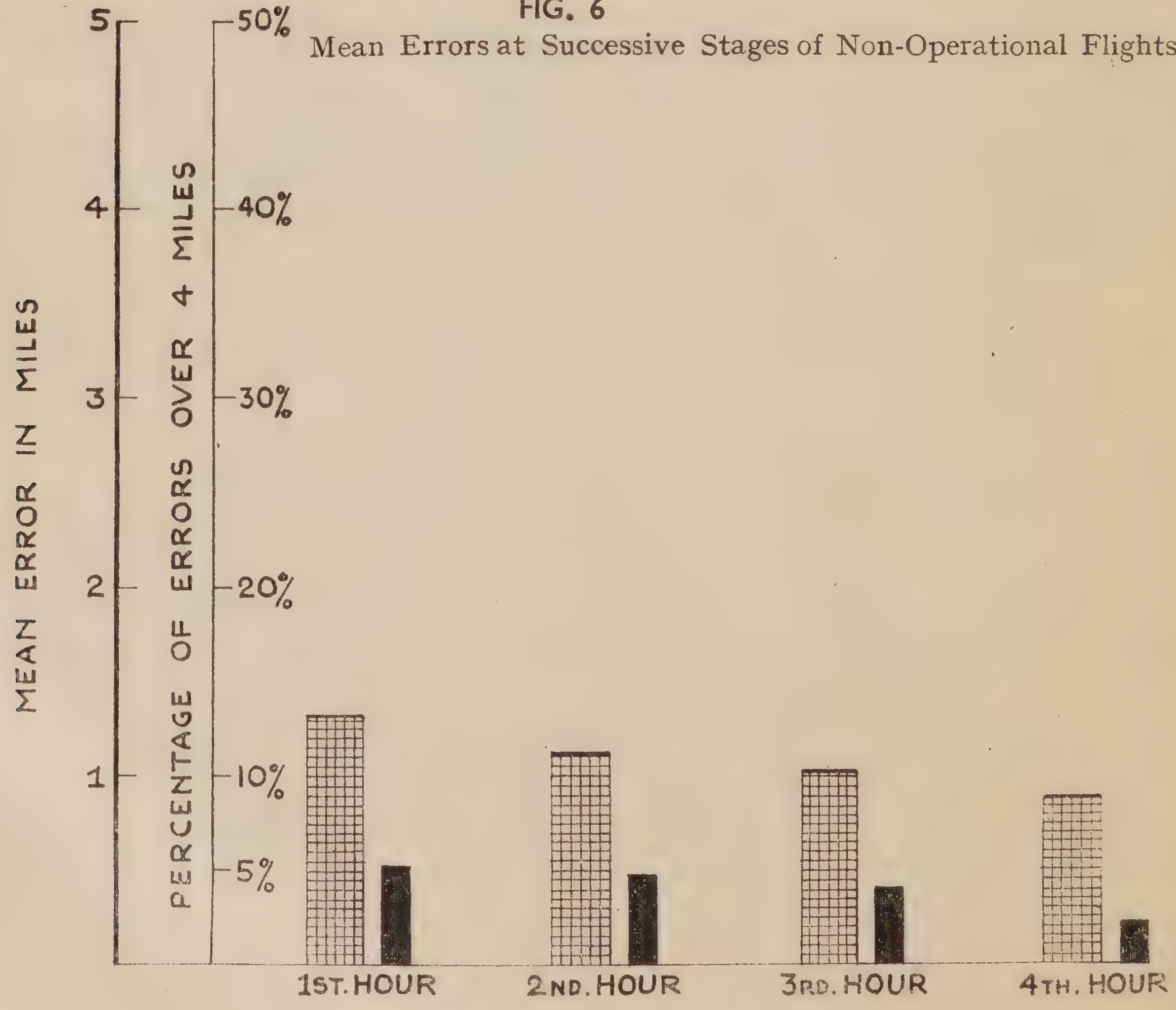


FIG. 6

Mean Errors at Successive Stages of Non-Operational Flights



3. Summary

(1) The errors in calculating and plotting wind vectors made by navigators engaged in a series of night bomber operational sorties have been analysed.

(2) By an arbitrary division of the routes to and from the target and plotting the sections where opposition was encountered, it was possible to compare the fluctuations in performance with the times of occurrence of acute hazard.

(3) Compared with the fluctuations in navigator performance during a series of non-operational flights, the level of efficiency during the operational sorties, which is lower at all stages than in the non-operational controls, varies considerably. The average error rises to a maximum during and after enemy opposition and falls again on the last part of the route back to base.

(4) It is suggested that these fluctuations are successively due to the effect on performance of anticipatory, acute and persistent anxiety. These effects seem to be larger than the effects of fatigue in the latter stages.

(5) A caution is given against too confident a translation of laboratory findings in studies of fatigue to operational settings where periods of acute anxiety are usual. The significance of variability of performance is discussed.

(6) The psychological interpretation of the data is used to explain some inconsistencies of performance in training and operations.

(7) The importance of stability under stress in the selection of key personnel is re-emphasised.

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Acknowledgments

My thanks are due to Mr. Sövig and Mr. Game of the Operational Research Section, Headquarters Bomber Command, Royal Air Force, whose co-operation made this study possible. I am also indebted to Professor A. Bradford Hill and Air Vice-Marshal Sir Charles P. Symonds for advice in interpretation of the data.

GLOSSARY

A_1B	Fit for full flying duties as pilot.
A_3B	Fit for full flying duties as combatant passenger.
A.C.H.	Aircrafthand.
A.D.G.B.	Air Defence of Great Britain.
A.E.A.F.	Allied Expeditionary Air Force.
A.F.U.	Advanced Flying Unit.
A.G.	Air gunner.
A.G.S.	Air Gunnery School.
A.N.S.	Air Navigation School.
A.O.C.	Air Officer Commanding.
A.S.R.	Air Sea Rescue.
Bale-out	Abandon aircraft by parachute.
B. and G.S.	Bombing and Gunnery School.
B.A.T.	Blind Approach Training.
Courage	Quality of persisting with a task despite fear.
Deep penetration	Flying deep into enemy territory.
Ditch, to	Make forced landing on water.
D.R. position	Position estimated by deduced reckoning, usually known as 'dead' reckoning.
Drink, in the	Having made forced landing on water.
E.F.T.S.	Elementary Flying Training School.
F.E.	Flight Engineer.
Fearlessness	Absence of fear where fear might be expected.
Flying stress	The load a man has to carry in the performance of flying duties, including emotional strain, skill fatigue, bodily fatigue, air-sickness, noise, glare, cold and altitude effects.
F.M.A.E.	Flight Mechanic—aero-engine.
Form 48	Medical history.
Freshman	Man on first operational flights.
George	Automatic pilot.
G.R.	General Reconnaissance.
Grading School	Elementary flying school used for selection.
H.C.U.	Heavy Conversion Unit.
Immediate (and non-) awards.	Decorations are usually deferred but may be given immediately after an achievement.
Inhibit	Suppress, prevent.
Innate tendencies	Tendencies to respond to external situations in a way which is determined by inheritance.
Intercom.	Internal telephone system in aircraft.
L.A.C.	Leading aircraftsman.
Lack of moral fibre	Term used in Air Ministry letter on the disposal of members of air crews who forfeit the confidence of their Commanding Officers. Equivalent to lack of courage.
M/U gunner	Mid-upper gunner.
Neurosis	Synonym—nervous breakdown. Illness shown by symptoms which are pyschological (mental) and/or physical (bodily). Neurosis is the result of failure to adapt to strain. The symptoms of neurosis are the same whether due to civilian worries, flying stress or other combatant duties. There is no such illness as flying stress.
N.Y.D.N. centres	Neuropsychiatric clinics.
Operation or op.	Flight against the enemy.
Operational limit	Fixed maximum of combat flying.
O.R.S.	Operational Research Section of commands.
O.T.U.	Operational Training Unit.
Overshooting (and under-).	—the runway on landing.

GLOSSARY—*continued*

P.M.O.	.. ..	Principal Medical Officer.
P.R.U.	.. ..	Photographic Reconnaissance Unit.
Psychologist ..	..	Scientist who specialises in the study of normal mental function.
Psychiatrist ..	..	A doctor who specialises in the diagnosis and treatment of psychological or mental illness.
P.T. ..	.. ..	Physical training.
Put up a black, to	..	Commit an error of technique, judgment or discipline.
R. Gunner	.. ..	Rear gunner.
Ropey	.. ..	Unsatisfactory or defective.
Scrubbing	.. ..	Cancelling operational trips.
S.F.T.S.	.. ..	Service Flying Training School.
Shell shock	.. ..	Term erroneously used to describe neurosis occurring in troops during the 1914–1918 war.
S.M.O.	.. ..	Senior Medical Officer.
Sortie	.. ..	Flight against the enemy.
Standing-by ..	..	Waiting in or near the aircraft at instant readiness for take-off.
Sweep..	.. ..	Fighter sortie in formation.
Taylor suit ..	..	Electrically-heated flying suit.
Tour (operational)	..	Completed period of operational flying (e.g. 30 sorties or 200 hours).
Trip ..	.. ..	Flight against the enemy.
U/S ..	.. ..	Unserviceable—refers to machines.
U/t ..	.. ..	Under training.
Waverer(-ing)	..	Man of defective morale in relation to operational flying.
W/O ..	.. ..	Warrant Officer.
W.Op.	.. ..	Wireless operator.
W.Op/A.G. (or /M)	..	Wireless operator air gunner (or mechanic).

INDEX

Subject | Page

Subject | Page

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